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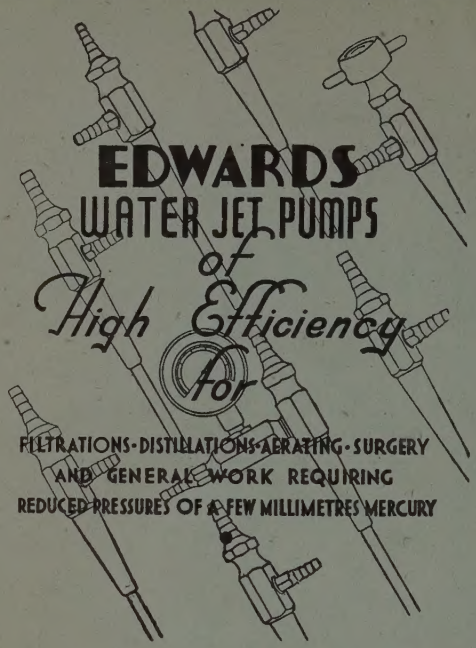

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61.22.055.5 423

Annual Report of the Indian Association for the Cultivation of Science for the Year 1943. *Proc. Indian Ass. Cult. Sci.*, 31 *pp.*, 1943.

89.6 : 77 *see Abstr.* 762

11.213 424

On certain sequences of integers no one of which is divisible by any other. CHARIAR, V. R. *Patna Univ. J.*, 1, *Nat. Sci. Sect.*, *pp.* 22–29, *July*, 1944.—A sequence (B), of positive integers, $b_1, b_2, \ldots$ is considered such that b_m is not a divisor of b_n unless $m = n$, when all the members of the sequence are written down without exception. The sequence (B) is uniquely determined by its first member. It is proved that (B) coincides with the sequence of primes after p^2 where p is the highest prime less than b_1. It is also proved that $\sum \frac{1}{b_n(\log b_n)^\delta}$ converges for every $\delta > 0$. Using these and other results, some properties are examined of a sequence of integers $a_1, a_2, \ldots$ such that a_m is not a divisor of a_n unless $m = n$. L. S. G.

12.52 : 517.53 425

Coefficients for interpolation within a square grid in the complex plane. LOWAN, A. N., AND SALZER, H. E. *J. Math. Phys.*, 23, *pp.* 156–166, *Aug.*, 1944.—In the neighbourhood of a point z_0 in the complex plane, a function is approximated by a quadratic or cubic polynomial. Tables of the coefficients appearing in these polynomials are given and there are some numerical illustrations, e.g. to find the value of $\tanh(0{\cdot}885 + 0{\cdot}265i)$ given a table of $\tanh z$ at intervals of 0·05 in x and y. L. S. G.

12.831 426

A modified treatment of the iterative method. SAIBEL, E. *J. Franklin Inst.*, 235, *pp.* 163–166, *Feb.*, 1943.—In the problem of determining the natural frequencies of a vibrating system it is necessary to solve a system of equations which may be written in the matrix form $\{x\} = \lambda G M\{x\}$ where $\{x\}$ is the column vector $(x_1, \ldots, x_n)$, M a diagonal matrix, $G = ||G_{ij}||$ is the matrix of influence coefficients, and λ is the square of the natural frequency. Associated with this equation are n characteristic functions $\phi_i(x)$ and corresponding characteristic numbers $\lambda_i (i = 1, \ldots, n)$ such that $\{\phi_i\} = \lambda_i G M\{\phi_i\}$ and the problem is to determine λ_1, where $\lambda_1 < \lambda_2 < \ldots < \lambda_n$. If we commence with an arbitrary column matrix $\{\psi\}_0$, the iterative procedure may be expressed in the form $\{\psi\}_{r+1} = GM\{\psi\}_r$ and the usual method for obtaining λ_1 is to take the ratio $R(r) = \{\psi\}_r/\{\psi\}_{r+1}$ for increasing r. We have $\lim_{r\to\infty} R(r) = \lambda_1$ but the rate of convergence depends upon the degree of separation of the λ's. It is shown that, for a given r, a better value of λ_1 is obtained by taking the value of $\frac{(\psi)_r M\{\psi\}_{r+1}}{(\psi)_{r+1} M\{\psi\}_{r+1}}$ where $(\psi)_r$ is the row vector corresponding to the column vector $\{\psi\}_r$. A numerical example is given. L. S. G.

512.831 427

A rapid method of inversion of certain types of matrices. SAIBEL, E. *J. Franklin Inst.*, 237, *pp.* 197–201, *March*, 1944.—The type of matrix inverted is one which occurs in problems of vibration and stability and its determinant is a continuant. But the method is applicable generally. If the given matrix $\mathbf{A}$ is partitioned into $\begin{pmatrix} \mathbf{A}_{11} & \mathbf{A}_{12} \\ \mathbf{A}_{21} & \mathbf{A}_{22} \end{pmatrix}$ and we write $\mathbf{C} = \mathbf{A}_{12}\mathbf{A}_{22}^{-1}$, $\mathbf{D} = \mathbf{A}_{21}\mathbf{A}_{11}^{-1}$, then, provided the latent roots of $\mathbf{CD}$ are less than unity in abs. value, we have

$$\mathbf{A}^{-1} = \begin{pmatrix} \mathbf{A}_{11}^{-1}\mathbf{H}, & -\mathbf{A}_{11}\mathbf{CK} \\ -\mathbf{A}_{22}^{-1}\mathbf{DH}, & \mathbf{A}_{22}^{-1}\mathbf{K} \end{pmatrix}$$

where $\mathbf{H} = (1 - \mathbf{CD})^{-1}$ and $\mathbf{K} = (1 - \mathbf{DC})^{-1}$. The given matrix $\mathbf{A}$ or its submatrices $\mathbf{A}_{ij}$ may always be so chosen so that it is unnecessary to invert any matrix of order higher than the third. A numerical example is given. L. S. G.

512.831 : 519.21 428

The probability of convergence of an iterative process of inverting a matrix. ULLMAN, J. *Ann. Math. Statist.*, 15, *pp.* 205–213, *June*, 1944.—Hotelling's method [Abstr. 772 (1944)] for computing the inverse of a given matrix $\mathbf{A}$ is to calculate $\mathbf{C}_1, \mathbf{C}_2, \ldots$ where $\mathbf{C}_{m+1} = \mathbf{C}_m(2\mathbf{I} - \mathbf{AC}_m)$, $\mathbf{C}_0$ being the initial approx. to $\mathbf{A}^{-1}$. A generalization of this is

$$\mathbf{C}_{m+1} = \mathbf{C}_m[\mathbf{I} + (\mathbf{I} - \mathbf{AC}_m) + (\mathbf{I} - \mathbf{AC}_m)^2 + \ldots + (\mathbf{I} - \mathbf{AC}_m)^k]$$

and the condition for convergence is that the latent roots of the matrix $\mathbf{I} - \mathbf{AC}_0$ be < 1 in abs. value. The probability of convergence in relation to the accuracy of the initial approx. $\mathbf{C}_0$ is examined and an expression is obtained for the number of decimal places required in the elements of $\mathbf{C}_0$ to make the probability 0·999. L. S. G.

512.831 : 621.3.01 429

Transformation matrices in electrical engineering. VOWELS, R. E. *J. Instn Engrs, Aust.*, 16, *pp.* 97–104, *June*, 1944.—[Abstr. 293 B (1945)].

513.443 = 4 430

Spheres associated with a tetrahedron. THEBAULT, V. *C.R. Acad. Sci., Paris*, 216, 1, *pp.* 21–23, 1943.—The 4 associated spheres are defined and their metrical properties are studied, including a determination of the sphere orthogonal to these 4. The sphere of Longchamps appears as a special case. The figure obtained by an inversion about the c. of g. of the tetrahedron is examined. L. S. G.

513.735 : 515.5 : 526.8 431

Scale curves in conformal maps. KASNER, E., AND DE CICCO, J. *Proc. Nat. Acad. Sci., Wash.*, 30, *pp.* 162–164, *July*, 1944.—A (1, 1) mapping is made of a surface Σ upon a plane π in which the co-ordinates are (x, y) where x and y are the parameters defining a point of Σ. The scale function $\sigma = ds/dS$ is the ratio of the corresponding elements of length in π and in Σ. It is independent of the direction only when the mapping is conformal. A scale curve on Σ (or π) is a curve along which the function σ does not vary. In the conformal case there are ∞^2 of these

given by $\sigma(x, y) = \text{const}$. Some theorems are given concerning σ when $\sum$ is a general surface and the mapping is conformal. The results are applied to the cartography of a sphere and it is shown that the only conformal map of a sphere upon a plane with straight scales is the Mercator projection and that the only conformal maps of a sphere upon a plane with circular scales are the Ptolemy sterographic and Lambert projections. L. S. G.

513.735 : 515.5 : 526.8 432

Scale curves in general cartography. KASNER, E., AND DE CICCO, J. *Proc. Nat. Acad. Sci., Wash.*, 30, *pp.* 211–215, *Aug.*, 1944.—The non-conformal map is considered [see Abstr. 431 (1945)]. If, on $\sum$, we have $dS^2 = Edx^2 + 2Fdxdy + Gdy^2$, where E, F, G are functions of x and y, the scale function σ is given by

$$\sigma^2 = \left(\frac{ds}{dS}\right)^2 = \frac{1 + y'^2}{E + 2Fy' + Gy'^2}$$

and there are ∞^2 scale curves, depending on the lineal element (x, y, y'). The differential equation for the scale curves is found and from this it is evident that there are 3 inflexional directions and 2 cuspidal directions, the latter being orthogonal. The relationship between scale curves and velocity systems [Abstr. 780 (1944)] is studied and it is shown that a system of scale curves can be of the cubic (Lie-Liouville) type if and only if it is a velocity system. The class of surfaces $\sum$ is determined for which there is a mapping on a plane π such that the scale curves coincide with the straight lines of π. In particular there exists no such non-conformal map of a sphere on a plane.

513.735.92 433

New systems of hypergeodesics defined on a surface. BELL, P. O. *Bull. Amer. Math. Soc.*, 49, *pp.* 575–580, *Aug.*, 1943.—A non-ruled surface S is referred to its asymptotic net as a parametric. As a point P moves along a curve C of S, the tangents at P to the u- and v-asymptotic curves of S describe 2 ruled surfaces R^u and R^v. S_ρ and S_σ are arbitrary transversal surfaces of the congruences of u- and v-tangents of S respectively. If R^u intersects S_ρ in an asymptotic curve of R^u, the curve C is said to be a ρ-tangeodesic of S. If R^v intersects S_σ in an asymptotic curve of R^v, then C is a σ-tangeodesic of S. The ρ- and σ-tangeodesics of S at P are studied and found to be intimately associated with the edges of Green, the directrices of Wilczynski and the projective normal of Fubini. A new geometric characterization is found for each of these lines. L. S. G.

513.761 434

Permutable periodic transformations. SMITH, P. A. *Proc. Nat. Acad. Sci., Wash.*, 30, *pp.* 105–108, *May*, 1944.—The so-called "special homologies" which have been used in a study of the topology of finite cyclic transformation groups are here applied to non-cyclic groups. L. S. G.

513.764 = 4 435

On the notion of equivalence in the sense of Poincaré. CHATELET, F. *C.R. Acad. Sci., Paris*, 216, 3, *pp.* 142–144, 1943.—Some remarks are made concerning the connection between the birational transforms of curves and varieties which have some rational points and whose equations have rational coefficients. Two curves (or varieties) are said to be equivalent in the diophantine sense if the rational points of one may be deduced from those of the other. A theorem due to Noether is generalized. L. S. G.

513.88 = 4 436

On weak convergence. JULIA, G. *C.R. Acad. Sci. Paris*, 216, 2, *pp.* 97–100, 1943.—It is shown that the necessary and sufficient condition that a sequence of points X_n (in a Hilbert or Banach space) converge weakly is that the difference of the squares of the distances from X_n to 2 fixed points have a limit for $n \to \infty$ for all pairs of fixed points. Several types of weak convergence are studied and some examples are given. L. S. G.

515.5 : 526.8 : 513.735 *see Abstr.* 431, 432

517.512.2 : 531.224 *see Abstr.* 497

517.512.2 : 621.317.757 437

An electrical circuit for harmonic analysis and other calculations. RYMER, T. B., AND BUTLER, C. C. *Phil. Mag.*, 35, *pp.* 606–616, *Sept.*, 1944.—[Abstr. 418 B (1945)].

517.512.2 : 621.317.757.082.52 438

A new photo-electric method for Fourier synthesis and analysis. FÜRTH, R., AND PRINGLE, R. W. *Phil. Mag.*, 35, *pp.* 643–656, *Oct.*, 1944.—[Abstr. 419 B (1945)].

517.512.4 439

On the complex zeros of the Bessel functions. HILLE, E., AND SZEGÖ, G. *Bull. Amer. Math. Soc.*, 49, *pp.* 605–610, *Aug.*, 1943.—By obtaining the Bessel function as the limit of a Laguerre polynomial, a proof is given of the classical theorem: the integral function,

$$z^{\frac{1}{2}\nu} J_{-\nu}(2z^{\frac{1}{2}}) = \sum_{m=0}^{\infty} \frac{(-z)^m}{m!\,\Gamma(m - \nu + 1)}$$

has precisely $[\nu]$ non-positive zeros. Here $J_{-\nu}$ is the Bessel function of order $-\nu$ and $\nu \geqslant 0$. If ν is integral, the zeros are all at the origin, and when ν is non-integral and $[\nu]$ is odd, there are precisely 1 negative zero and $\frac{1}{2}([\nu] - 1)$ pairs of conjugate complex zeros; when ν is non-integral and $[\nu]$ is even, there are $\frac{1}{2}[\nu]$ pairs of conjugate complex zeros. L. S. G.

517.53 : 512.52 *see Abstr.* 425

517.53 = 4 440

On certain arithmetic applications of the theory of residues. ROUSSEL, A. *C.R. Acad. Sci., Paris*, 216, 1, *pp.* 20–21, 1943.—A function $f(z)$ is holomorphic in an area A bounded by a contour C. If $f(z)$ has an integral value at k points in A, the number k may be found by putting $F(z) = \sin\{\pi f(z)\}$ and noting that k equals the number of roots of $F(z)$ within A. Thus

$$k = \frac{1}{2\pi i}\int_C \frac{F'(z)}{F(z)}dz = \frac{1}{2i}\int_C f'(z)\cot\{\pi f(z)\}dz$$

An application is made to the number (k) of divisors of a given integer p. If C is suitably defined, we have, putting $f(z) = p/z$, $k = -\dfrac{p}{2i}\displaystyle\int_c \frac{1}{z^2}\cot\{\pi p/z\}dz$. L. S. G.

517.534.2 441

Zeros and poles of functions defined by Taylor series. GOLOMB, M. *Bull. Amer. Math. Soc.*, 49, *pp.* 581–592, *Aug.*, 1943.—Numerical methods are presented for

termining the poles and zeros, and, in particular, e number of poles on the circle of convergence C. sides determining the polynomial whose zeros are the poles (on C) of the expanded function with eir proper multiplicities, the polynomial whose ros are the poles of highest order only is also found. ne results are based on formulae for evaluating rsymmetric determinants whose elements are suc- ssive Taylor coefficients of rational and mero- orphic functions. An application is made to the aluation of the zeros of smallest absolute value of nctions given by Taylor series, e.g. the 2 conjugate mplex roots z_1, z_2 of smallest absolute value of $z) = z - e^z = 0$ are found to be given by $z_1 z_2$ $1{\cdot}88940\ldots$ and $z_1 + z_2 = 0{\cdot}63626\ldots$ L. S. G.

7.564.3 442

Zeros of Bessel functions. SMITH, D. B., RODGERS, M., AND TRAUB, E. H. *J. Franklin Inst.*, 237, 301–303, *April*, 1944.—The tables give the positive al roots between 0 and 25 for function and first rivative of Bessel functions of the first kind.

17.949 = 4 443

An asymptotic property of the solutions of certain near finite-difference equations. FAN, K. *C.R. Acad. ci., Paris*, 216, 4, *pp.* 169–171, 1943.—A proof is ven of the theorem: If, in the equation

$$\Delta^m y(n) + g_{m-1}(n)\Delta^{m-1}y(n) + \ldots + g_1(n)\Delta y(n) + g_0(n)y(n) = h(n)$$

e series $\sum_{n=1}^{\infty} n^{m-k-1}|g_k(n)|$; $(k = 0, 1, \ldots, m-1)$, nd $\sum_{n=1}^{\infty} h(n)$ are convergent, then the limits

$$\lim_{\to\infty} \frac{(m-k-1)!}{n^{m-k-1}} \Delta^k y(n), \ (k = 0, 1, \ldots, m-1)$$

xist and they are all equal to the solution of the quation. L. S. G.

8.4 : 576.8.095.4 *see Abstr.* 730

18.4 = 4 444

Determination, by the condition of least error, of a ormula, depending on linear parameters, for represent- g an experimental curve. VERNOTTE, P. *C.R. Acad. ci., Paris*, 216, 1, *pp.* 33–35, 1943.—A line $y = Ax + B$ to be fitted to a set of experimental data. A method given for determining A and B and some general ormulae for A and B are given when the representation to hold over the interval $(-N, N)$ where N proceeds ver the range 0·5 (0·5) 5·5. L. S. G.

18.4 = 4 445

Representation of an experimental curve, in the eneral case, by the condition of least error. VERNOTTE, . *C.R. Acad. Sci., Paris*, 216, 3, *pp.* 148–150, 1943.— continuation of a previous paper [Abstr. 444 (1945)] here the curve to be fitted has the form $y = (x, A, B, C)$. A method is given for finding , B and C from a set of experimentally determined oints. L. S. G.

18.43 446

Some refinements in methods of graphical integration. ONNELL, L. H. *J. Franklin Inst.*, 233, *pp.* 331–348, *pril*, 1942.—Intended primarily for numerical olution of first-order differential equations, equal lope lines are first plotted, their equations following from the substitution of $\tan n\theta$ for the derivative in the equations; θ is some convenient angle such as 15° and n has successive integral values 0, 1, 2, 3, etc., as may be required. The integral curve is drawn to cross these lines at the slope angle $n\theta$, either directly by French curve or by a refinement of a straight-line approximation which gives the envelope of tangents. Where the slope is changing rapidly, the points are close together. Points of inflexion may cause an apparent anomaly; suitable treatment is explained. G. F. F.

518.43 447

Differentiation with the cinema integraph. PEKERIS, C. L., AND WHITE, W. T. *J. Franklin Inst.*, 234, *pp.* 17–29, *July*, 1942.—Numerical integration can be applied to central, forward or backward numerical differentiation, using weighting functions obtained from Hermite polynomials in the first case and Laguerre polynomials in the two latter cases. Examples of the use of the cinema integraph in this way are given. With empirical data, the error in the derivative is from 3 to 5 times the error in the data. G. F. F.

518.5 448

The abridger. LEIVESLEY, V. W. *J. Instn Engrs, Aust.*, 16, *pp.* 157–158, *July–Aug.*, 1944.—This is a slide rule with special scales intended to facilitate numerous calculations mainly of electrical engineering interest. Worked examples are included in the text. The main scales are the usual logarithmic A and B on stock and slide, curtailed to a range of 1 to 20, a duplicate of B in the C position on slide, and, in place of the D scale on the stock, a scale which gives cosines in positions corresponding to sines as read on the A scale. G. F. F.

519.21 : 512.831 *see Abstr.* 428

519.24 : 620.113.2 449

Refined quality control speeds up production. GAILLARD, J. *Elect. Commun.*, 22, 1, *pp.* 3–10, 1944.—[Abstr. 244 B (1945)].

519.24 : 620.113.2 450

Quality control inspection. COLASANTI, J. *Min. Mag.*, 34, *pp.* 335–337, *July*, 1944.—[Abstr. 243 B (1945)].

519.251 : 620.113 451

The statistical control of accuracy in routine analysis. MACCOLL, H. G. *Chem. and Ind.*, 49, *pp.* 418–421, *Dec.* 9, 1944.—[Abstr. 242 B (1945)].

519.251 : 620.113.2 452

The industrial lot and its sampling implications. SIMON, L. E. *J. Franklin Inst.*, 237, *pp.* 359–370, *May*, 1944.—[Abstr. 245 B (1945)].

519.41 453

Possible numbers of non-invariant operators of a group. MILLER, G. A. *Proc. Nat. Acad. Sci., Wash.*, 30, *pp.* 114–117, *May*, 1944.—A continuation of a previous paper [Abstr. 1511 (1944)]. An enumeration is made of all the possible non-Abelian groups which separately contain no more than 11 non-invariant operators. It is shown that, when the order of the central quotient group of a group G is a certain power of a prime number, the order of G is divisible by a higher power of this prime number and hence the order of the central of G is divisible by this prime

number. Some other enumerative results are given and there is a discussion of dihedral groups. L. S. G.

519.44 454

On the arithmetic in a group ring. BRAUER, R. *Proc. Nat. Acad. Sci., Wash.*, 30, *pp.* 109–114, *May*, 1944.—A group G of finite order determines an associative algebra Γ, the group ring, over a field K. This algebra consists of all linear combinations $\alpha = \sum a_i G_i$ where $G_i \varepsilon G$ and $a_i \varepsilon K$. A study is made of certain arithmetic properties of Γ with a view to applications in the investigation of groups of finite order. The element α is an integer of Γ if the a_i are all integers of K. The ring J of the integers α is not maximal so that the ordinary theory of ideals does not hold. The main topic of the paper is a study of how a prime ideal $\mathfrak{p}$ of K behaves in J. This involves a study of the residue class ring $J^* = J/(\mathfrak{p})$. L. S. G.

519.48 = 6 455

On the theory of rings. SAGASTUME BERRA, A. E. *Publ. Fac. Cienc. Fis-Mat. La Plata*, 174, *pp.* 107–141, *July*, 1944.—Some general properties of rings are noted and some theorems are proved concerning the set of regular elements and the set of units. Quotient rings are studied in considerable detail and some examples are given. L. S. G.

522.61 : 771.54 456

The astronomical aspect. HUNTER, A. *Photogr. J.*, 84, *pp.* 288–290, *Oct.*, 1944.—Describes the procedure followed in astronomical photometry and indicates some of the ways (low light flux) in which this work differs from other sensitometric work. The intermittency effect is discussed. The nature of astronomical work renders necessary deviations from ideal procedure and the effect of some of these deviations is examined. A. H.

522.617.3 : 535.244 : 535.247.4 *see Abstr.* 558

523.161 457

Interstellar sodium lines in stars of classes R and N. SANFORD, R. F. *Publ. Astr. Soc. Pacif.*, 54, *pp.* 257–258, *Dec.*, 1942.—Stellar and interstellar velocities are given for 6 late-type stars in which the lines are well separated. A. HU.

523.3 458

Lunar coronae. DE LA BERE, J. C. W. *Nature, Lond.*, 154, *p.* 613, *Nov.* 11, 1944.

523.66 459

Periodic comet Wolf I. BAADE, W. *Publ. Astr. Soc. Pacif.*, 54, *pp.* 259–260, *Dec.*, 1942.—Photographs on the 100 in. reflector show a semi-stellar head from which a 16″ tail extended at position angle 300°. Corrections to the ephemeris are derived. A. HU.

523.746 460

On sunspots and the solar cycle. ALFVÉN, H. *Ark. Mat. Astr. Fys.*, 29*A*, 2, *No.* 12, 17 *pp.*, 1943.—Sunspots are regarded as disturbances in the sun's normal magnetic field caused by the arrival at the surface of a magneto-hydrodynamic wave [see Abstr. 637 (1945)]. The motion of such waves from the centre is investigated; and the direction and velocity of the intersection betw. the wave front and the surface are found to be the direction and velocity of the spot zones in their motion towards the equator. The waves may originate in the Sun's non-uniform rotation. They are identified with standing waves the lines of force excited by rotational turbulenc and the 11-year cycle is probably the resonance perio of lines of force in the solar interior $^2/_7$ of the radi from the centre. An observed period of 70–80 y is also explicable on the theory suggested. A. H

523.746 46

Provisional sunspot-numbers for April to May, 194 BRUNNER, W. *Terr. Magn. Atmos. Elect.*, 49, *p.* 15 *Sept.*, 1944.

523.746 : 538.6 46

On the effect of a vertical magnetic field in a co ducting atmosphere. ALFVÉN, H. *Ark. Mat. As Fys.*, 29*A*, 2, *No.* 11, 6 *pp.*, 1943.—The decay of magnetic field in a body of finite electrical conductivi is studied, and the results applied to the fields sunspots, which are found to create currents in the decay which are large enough to cause the decay proceed very slowly. Static equilibrium in an ide gas under the influence of gravitation and a vertic field is possible only if the temperature in the fie is lower than that outside it: thus sunspots a relatively cool because of their fields. The action radiation in smoothing out the temperature differen will produce convection currents qualitatively simil to the observed Evershed effect. The hydrostat pressure gradient set up by the interaction bet the induced currents and the field is of the ord necessary if the cooling is produced by convection. A. H

523.746 : 550.384 *see Abstr.* 718

523.746.5 : 550.384 : 550.37 *see Abstr.* 715

523.752 46

The eruptive prominence of October 3, 1942. PETT E. *Publ. Astr. Soc. Pacif.*, 54, *pp.* 253–255, *Dec* 1942.—An interactive prominence passing over to t eruptive form is described. Measurements made alo its trajectory give a distance/time diagram showing uniform velocity of 14 km./sec. which persisted f nearly an hour before changing rapidly to one 21 km./sec. lasting $^3/_4$ hr., and then to one 42 km./sec. A. H

523.755 46

On a physical theory of the solar corona. SAH M. N. *Proc. Nat. Inst. Sci. India*, 8, 1, *pp.* 99–12 1942.—The existence of highly-stripped ions of F Ca and Ni in the inner corona [Abstr. 344 (1943 may be due either to bombardment of the sol atmosphere by meteoric dust or to production of t ions inside the solar envelope. The first mechanis is found to be quantitatively inadequate to produ the observed excitation; the second is developed b supposing that nuclear reactions similar to U fissio occur in the lower atmosphere and produce strippe atoms or bare nuclei which, projected through t chromosphere with energies of millions of volt pick up enough electrons to emit visible lines in t corona. Electrons liberated from solar atoms b collision during this passage form the outer coron Energetic considerations suggest that in the case iron the particle is formed as Fe^{+16} with an energ of about 60 eMV. The range and energy-balance such ions in the solar atmosphere are calculated an shown to accord with known facts. A programm of further work is indicated. A. H

523.78 : 525.23 *see Abstr.* 482, 483

523.802 465

On some formulae for the computation of space densities. MALMQUIST, K. G. *Ark. Mat. Astr. Fys.*, *29B*, 2, *No.* 8, 7 *pp.*, 1943.—Simplified formulae are given for computing the space densities of stars from the distribution of their apparent magnitudes, given that the distribution of absolute magnitudes in an element of space is Gaussian. A. HU.

523.841.1 466

Photographic light curve of Nova Aquilae, 1943. GAPOSCHKIN, S. *Bull. Harv. Coll. Obs.*, *No.* 917, *pp.* 16–17, *Dec.* 1, 1943.—All available Harvard observations of the magnitude of this nova are collected. It rose from fainter than magnitude 17·5 to 6·4 at max. and declined to 13·5 in 7 months. A. HU.

523.841.11 467

The expanding shell around Nova Herculis. BAADE, *N. Publ. Astr. Soc. Pacif.*, 54, *pp.* 244–249, *Dec.*, 1942.—Photographs taken at the Cassegrain focus of the 100 in. telescope show such a diminished surface brightness of the nebula surrounding this nova that the central star is visible. The structure of the spectral lines N1, N2 and Hβ suggests that the nebula is an ellipsoidal shell whose thickness is about half its outer radius. The duplicity observed visually is attributed to bright condensations close to the inner boundary of this shell. The emission in the red (6 300–6 700 Å) consists of 2 pairs of condensations on the minor and major axes, superposed on a weak emission over the whole nebula. These localized emissions are due to forbidden N II lines at 6 548, 6 584 Å. A. HU.

523.841.11 468

Visual magnitudes of Nova Puppis 1942. PETTIT, E. *Publ. Astr. Soc. Pacif.*, 54, *p.* 259, *Dec.*, 1942.—Measurements with a wedge photometer on a 6 in. refractor between Nov. 10 and 19 show that max. occurred on Nov. 11. The star is the third brightest nova in the past 300 yr. A. HU.

523.841.11 : 523.872 469

The spectrum of Nova Cygni 1942. SANFORD, R. F. *Publ. Astr. Soc. Pacif.*, 54, *pp.* 255–256, *Dec.*, 1942.—Two series of spectrograms secured when the nova was of apparent mag. 9 and 15, respectively, are described. The earlier ones show a continuous spectrum overlaid by emission bands, chiefly of H, and by absorption bands suggesting shells expanding at 500 km./sec. and at about 1 300 km./sec. After the decline in magnitude the continuum and the H emission weakened rel. to allowed and forbidden Fe II emission bands. A. HU.

523.841.11 : 523.872 470

Nova Puppis 1942. HUMASON, M. L., AND SANFORD, R. F. *Publ. Astr. Soc. Pacif.*, 54, *pp.* 256–257, *Dec.*, 1942.—Spectrograms secured betw. Nov. 11 and Nov. 15 show a continuous spectrum with emission H bands with wide hazy absorption edges on their violet sides, indicating a shell expanding at 4 000 km./sec. Broad absorption lines due to Fe II and Si II are also present. The velocity from the interstellar lines gives an absolute mag. of −11, suggesting that N. Puppis is a very bright galactic object. A. HU.

523.841.2 471

Pulsation and white dwarfs. BHATNAGAR, P. L. *Nature, Lond.*, 154, *p.* 606, *Nov.* 11, 1944.

523.841.3 472

Eighty-one new variable stars in VSF 524 and 566. BOYCE, E. H. *Bull. Harv. Coll. Obs.*, *No.* 917, *pp.* 1–5, *Dec.* 1, 1943.—Types, periods and limiting magnitudes are determined for 81 new variables in these high-latitude fields, which lie betw. the Magellanic Clouds. The distribution of types is normal for the latitude. It is uncertain whether a nova found is a distant associate of the Large Cloud or is a supernova in NGC 1511. A. HU.

523.841.3 473

Indices to Harvard variable-star numbers and to published variable-star fields. SHAPLEY, H., AND BOYCE, E. H. *Bull. Harv. Coll. Obs.*, *No.* 917, *pp.* 18–21, *Dec.* 1, 1943.—An index to discovery announcements from HV 3985 to the current HV 11975; and a finding list for position, number of variables and place of publication for Harvard variable-star fields up to VSF 566. A. HU.

523.841.35 474

BN Monocerotis: an N-type variable. EDMONDSON, F. K., AND GICLAS, H. L. *Astrophys. J.*, 100, *pp.* 1–7, *July*, 1944.—Photographic, photovisual and photo-red observations made with 7 different telescopes over the past 19 yr. are used to study the light and colour variations of this star. The variation is of the semi-regular type with a main period of 500 days and amplitudes of 3 mag., 1 mag. and <1 mag. in the respective spectral regions. The colour index varies from +4 to +6 mag., the red index from +5·5 to +7·5 mag.; both are strongly correlated with photographic magnitude. A. HU.

523.841.37 475

Ephemeris corrections for seven Cepheid variables. ASHBROOK, J. *Bull. Harv. Coll. Obs.*, *No.* 917, *p.* 10, *Dec.* 1, 1943. A. HU.

523.841.9 476

Notes on five eclipsing stars. PAYNE-GAPOSCHKIN, C. *Bull. Harv. Coll. Obs.*, *No.* 917, *pp.* 7–8, *Dec.* 1, 1943.—Five known variables (RV Vel, RX Vel, TZ CrA, UU CrA, and RS Ind) are shown to be of eclipsing type, and elements are derived. A. HU.

523.841.9 477

GR Carinae. PRAGER, R. *Bull. Harv. Coll. Obs.*, *No.* 917, *pp.* 8–10, *Dec.* 1, 1943.—Discrepancies betw. predicted and observed magnitudes of this Algol-type star disappear if a period three times that previously announced is used, two min. being assumed with a separation of about $^1/_3$ the period. No reliable light curve is yet available, but the min. seem to be nearly equal in depth and of very short and very different durations. A. HU.

523.841.9 478

Notes on seven eclipsing stars. GAPOSCHKIN, S. *Bull. Harv. Coll. Obs.*, *No.* 917, *pp.* 11–15, *Dec.* 1, 1943.—V444 Cygni is a Wolf–Rayet eclipsing binary showing shallow minima of very unequal widths. X Gruis has a single min. of depth 2·1 mag., and probably consists of 2 components unequal in size, luminosity and mass. The components of TV Normae are probably sub-dwarfs of type A, of mass about

1·6 times that of the Sun but of radius only about $1/5$ that of the Sun. Light curves are given for U Scuti, W Scuti and RZ Scuti. The system RY Scuti is discussed using some new data, and previous conclusions as to the unique character of its components and of the surrounding envelope and nebula are confirmed. A. HU.

523.842.2 479

The frequency of distant companions. WILLIAMS, E. T. R., AND VYSSOTSKY, A. N. *Publ. Astr. Soc. Pacif.*, 54, *pp.* 260–263, *Dec.*, 1942.—McCormick parallax plates are examined to find distant companions of the same proper motion as the parallax star. The regions are chosen if the annual motion of the parallax star exceeds 0″·1 in one co-ordinate. Companions are listed if they are >1′ distant. Min. frequencies of occurrence are 7% for primaries brighter than mag. 5·3; 3% for fainter primaries. Many are missed because they are obscured by the rotating sector or are too faint, but it is concluded that among the brighter stars there are as many companions at distances >1 000 astronomical units as there are visual doubles on Aitken's definition. A. HU.

523.842.2 480

Distant companions of 36 Ursae Majoris. VYSSOTSKY, A. N., AND REUYL, D. *Publ. Astr. Soc. Pacif.*, 54, *p.* 263, *Dec.*, 1942.—Attention is drawn to an M0 dwarf of mag. 9 at 2′ from this star and sharing its proper motion; and to a K0 star of mag. 8 more than 1° away which moves with the pair. A. HU.

523.872 481

Molecules: their rôle in astronomy. SWINGS, P. *Publ. Astr. Soc. Pacif.*, 54, *pp.* 232–236, *Dec.*, 1942.—The presence of molecules in celestial bodies is deduced from bands and continuous absorption in their spectra and from their effect on the abundance of certain free atoms. A review of the molecules found and of their mode of excitation is given. The high abundance of molecules in the atmospheres of late-type stars is connected with the atomic line emission shown in their spectra. The importance of molecular spectra in studies of the chemical composition and abs. magnitudes of stars is emphasized. The distinction betw. the M and the R and N stars is attributed not to differing abundances of O and C in atmospheres in thermodynamic equilibrium, but to the effect of departures from thermodynamic equilibrium in chemically similar atmospheres. Similar departures profoundly modify the excitation conditions in interstellar space and in comets. Future work should include laboratory investigations of bands of astrophysical interest, and extension of astronomical observations to the infra-red. A. HU.

523.872 : 523.841.11 *see Abstr.* 469, 470

525.23 : 523.78 482

Atmospheric-electric observations at Huancayo, Peru, during the solar eclipse, January 25, 1944. JONES, M. W., AND GIESECKE, A. A. *Terr. Magn. Atmos. Elect.*, 49, *pp.* 119–122, *June*, 1944.—Special observations were made of certain geophysical elements during this partial eclipse, which lasted 2 h. 40 m. and reached 85% totality at Huancayo. During the eclipse the potential gradient decreased, the positive and negative conductivities increased, the air-earth current density increased and the nuclei-count decreased. The effects are attributed to decreasing solar heating of the lower atmosphere [see Abstr. 483 (1945)]. A. HU.

525.23 : 523.78 483

Discussion of "Atmospheric-electric observations at Huancayo, Peru, during the solar eclipse, January 25, 1944." GISH, O. H. *Terr. Magn. Atmos. Elect.*, 49, *pp.* 123–124, *June*, 1944.—The observations [Abstr. 482 (1945)] are compared with similar ones made at Lakin, Kansas, during the eclipse of June 8, 1918. The close similarity found is linked with the fact that the normal diurnal variations of potential gradient and of conductivity are of the same character at the 2 places. It is suggested that conditions at both sites favour the development at night of a stable stratum of air near the ground. In general, no close correlation betw. tropospheric electric elements and solar radiation is to be expected. A. HU.

525.73 = 4 484

On the astronomical refraction. ESCLANGON, E. *C.R. Acad. Sci., Paris*, 216, 2, *pp.* 100–103, 1943.—The usual formula for this refraction (i.e. the angle between the initial direction of a light ray and the direction of the ray on reaching the earth's surface) is only useful for zenith distances less than 75°. A new formula is established which permits rapid calculation even when this restriction is removed. It involves the function $\psi(x) = e^{x^2}\int_x^\infty e^{-x^2}dx$. L. S. G.

525.73 = 4 485

On geodetic refraction. ESCLANGON, E. *C.R. Acad. Sci., Paris*, 216, 3, *pp.* 137–139, 1943.—The results of a previous paper [Abstr. 484 (1944)] are used to determine the refraction between 2 geodetic stations. L. S. G.

526.6 : 551.241 *see Abstr.* 723

526.8 : 515.5 : 513.735 *see Abstr.* 431, 432

526.92 : 551.510.535 : 621.396.9 486

Historical notes on the determination of distance by timed radio waves. TUSKA, C. D. *J. Franklin Inst.*, 237, *pp.* 1–20, *Jan.*, *and pp.* 83–102, *Feb.*, 1944.—[Abstr. 543 B (1945)].

527 : 538.7(09) *see Abstr.* 638

527 : 621.396.932.2 : 531.383 *see Abstr.* 501

530.12 : 531.51 487

Comparison of a degenerate form of Einstein's with Birkhoff's theory of gravitation. WEYL, H. *Proc. Nat. Acad. Sci., Wash*, 30, *pp.* 205–210, *Aug.*, 1944.—A reply to a recent paper by Barajas [Abstr. 1955 (1944)]. More detailed analysis is given in which the complete and "degenerate" Einstein theories are compared with the theory of Birkhoff. L. S. G.

530.12 : 531.51 488

On Birkhoff's new theory of gravitation. BARAJAS, A., BIRKHOFF, G. D., GRAEF, C., AND VALLARTA, M. S. *Phys. Rev.*, 66, *pp.* 138–143, *Sept.* 1 *and* 15, 1944.—[See Abstr. 79 (1944)]. In the theory based on flat space-time, the red shift is accounted for by the energy change of the photon as it travels from the emitting body, whereas the photon plays no especial rôle in the Einstein theory; the solution of the problem of 2 or more bodies is feasible in the new theory because of its simpler character. Four comments of Weyl

e discussed. The perfect fluid used by Birkhoff as e ultimate carrier of mass and electric charge is to characterized as the simplest fluid with disturbance locity that of light (c). The differential equations the theory are set up. An additional cosmological rm in the gravitational potentials h_{ij} is suggested: $= (K/8)(t^2 - x^2 - y^2 - z^2)g_{ij}$, where x, y, z, t are orentz co-ordinates and K is the (small) cosmo- gical const. The explicit formula for the rate of dvance of periastron P of two bodies of masses m and $_2$ is given, as obtained from the solution of the body problem in the theory, and its possible applica- on to double stars is referred to.

30.145 489

On the connection of Dirac's quantum-electro- ynamics and the theory of radiation damping. GORM- Y, P. G., AND HEITLER, W. *Proc. R. Irish Acad.*, *A*, 4, *pp.* 29–49, *Sept.*, 1944.—Dirac's recent ttempt [Abstr. 1742 (1942), 351 and 352 (1944)] to ee the relativistic theory of quantized fields from the ivergences which prevent an exact application to hysical problems is compared with the theory of adiation damping [Abstr. 2558 (1942)] in which a euristic attempt is made to derive a divergence-free ormalism by simply omitting the divergent integrals rom the original formalism. Both theories are orentz-invariant and have certain other common eatures, but they are not identical. It is shown that i) for a small number of problems, including the non- elativistic scattering of a quantum by a particle with arge rest mass, the two theories give practically dentical results, (ii) for more complicated processes, especially the scattering of a quantum with energy arge compared with the rest energy of the scattering particle and even more so for multiple processes, the wo theories are widely different, (iii) for certain roblems, Dirac's theory has no solution at all. This is shown to be the case for the relativistic scatter- ng of a high-energy quantum. The difficulty (iii) is ue to negative-energy quanta, and this part of Dirac's heory may have to be abandoned. L. S. G.

530.145.5 : 537.12 490

Planck's universal constant of action. COOK, S. R. *Proc. Amer. Phys. Soc., Berkeley, Cal., July* 22, 1944. *Abstr. in Phys. Rev.*, 66, *p.* 161, *Sept.* 1 *and* 15, 1944.— The paper purports to show (1) that Planck's first constant is the real universal constant of action, e, (2) that the ratio of e and h is a definite const. of proportionality k.

530.145.61 491

A note on eigenphases and eigenfunctions of certain continuous spectra. HULTHÉN, L. *K. Fysiogr. Sällsk. Lund. Förh.*, 14, 8, 6 *pp.*, 1944.—An asymptotic solution of the Schrödinger equation for a system of 2 particles is, for large r, of the form $\sin(kr - \frac{1}{2}l\pi + \eta_l)$ where l is a quantum number, and η_l is called the eigenphase. A general formula for η_l is established and the first- order effect of a perturbation is calculated. A group of identities involving the solutions of the Schrödinger equation is also obtained and these are useful in practical computation of eigenfunctions and eigen- phases [see Abstr. 492 (1945)]. L. S. G.

530.145.61 492

Variational problem for the continuous spectrum of a Schrödinger equation. HULTHÉN, L. *K. Fysiogr. Sällsk. Lund. Förh.*, 14, 21, 13 *pp.*, 1944.—The continuous spectrum is linked with a variational problem in which the eigenphase (defined by the asymptotic behaviour of the eigenfunction) plays a part similar to that of an eigenvalue. The result is a variational method for approximating the eigen- function and the phase, the latter being obtained very accurately because of its stationary character. A par- ticular case treated is the continuous S-spectrum of deuteron. L. S. G.

530.145.63 : 538.615 493

A note on Dirac equations and the Zeeman effect. BOSE, S. N., AND BASU, K. *Indian J. Phys.*, 17, *pp.* 301–308, *Dec.*, 1943.—The Dirac equations for hydrogenic atoms are solved by a new method, the radial functions being expressed in terms of a combina- tion of 2 Sonine's polynomials of consecutive degrees. The equations are also solved when the atom is in an electromagnetic field, some elementary properties of the Sonine polynomials being used. The result is that the problem of the Zeeman effect in a general (homo- geneous) field may be solved and the standard quadratic equation for the energy is obtained. L. S. G.

530.145.65 = 4 494

Representation of a system of identical particles by a symmetrical wave function. COURTOIS, J. *C.R. Acad. Sci., Paris*, 216, 1, *pp.* 35–37, 1943.—The wave functions are given for particles with spin and without spin, and a new normalizing convention is stated. The wave functions arising when 2 systems co-exist are set up and studied. L. S. G.

530.145.65 : 535.14 = 4 495

Representation of an unlimited number of particles. COURTOIS, J. *C.R. Acad. Sci., Paris*, 216, 3, *pp.* 146–148, 1943.—A system of particles having a symmetric wave function is considered. The results of a previous paper [Abstr. 494 (1945)] are used and an applica- tion is made to photons. L. S. G.

531.19 : 536.7 : 539.152.1 496

Statistical mechanics at extremely high temperatures. WATAGHIN, G. *Phys. Rev.*, 66, *pp.* 149–154, *Sept.* 1 *and* 15, 1944.—[See Abstr. 1532 (1944)]. Equilibrium conditions between elementary particles and nuclei at temperatures $T \gtrsim 10^9$ deg. are studied. Three temperature intervals below the upper limit $\sim 10^{12}$ deg. [$kT \sim 10^8$ eV] are considered. Because of the behaviour of high-energy particles, limitations arise to the validity of the laws of quantum statistics, in accordance with the idea of the existence of a supple- mentary indeterminacy for high-energy particles and a lower limit for measurable lengths. Astrophysical aspects of the phenomena of pair production and of the gravitational effect of light particles are discussed. The results concerning pair production at $\sim 10^9$ deg. are summarized. General formulae for thermal equilibrium between nuclei and light particles are given.

531.224 : 517.512.2 497

Application of the Fourier method to the solution of certain boundary problems in the theory of elasticity. PICKETT, G. *J. Appl. Mech.*, 11, *A*176–*A*182, *Sept.*, 1944.—The Fourier method is used to obtain exact solutions for stresses in rectangular prisms or circular cylinders for any boundary condition.

531.258 498

The bending of the cylindrically aeolotropic plate. CARRIER, G. F. *J. Appl. Mech.*, 11, *A*129–*A*133, *Sept.*, 1944.—The small-deflection theory, applicable to plates of cylindrically aeolotropic material, is presented, and expressions are obtained for the moments and deflections produced by the following combinations of loading and boundary conditions: The disc clamped along its circumference and loaded by a uniform lateral pressure; the clamped disc loaded by a central concentrated force; the simply supported disc loaded by uniform edge moment; the disc with a rigid core clamped along its circumference and loaded by a central concentrated force; the ring clamped along its outer edge and loaded by a uniform shear distribution along the inner edge; the simply supported disc with an elastic isotropic core loaded by a uniform edge moment; and the disc under the loading given by $p = p_0 r \cos\theta$.

531.258 499

Strengthening of circular holes in plates under edge loads. BESKIN, L. *J. Appl. Mech.*, 11, *A*140–*A*148, *Sept.*, 1944.—Stress distributions are determined around strengthened circular holes in plates submitted to edge loads at infinity. Various proportions of circular strengthenings are considered, and three conditions of applied edge loads are investigated; uniform hydrostatic stress, uniform shearing stress, uniform axial stress. The stress-concentration factors are defined by the ratio of the critical stress, computed by the distortion-energy theory, to the critical stress at infinity, which is the critical stress in the plate without hole.

531.3 : 621.93 500

Basic mechanics of the metal-cutting process. MERCHANT, M. E. *J. Appl. Mech.*, 11, *A*168–*A*175, *Sept.*, 1944.—[Abstr. 575 B (1945)].

531.383 : 527 : 621.396.932.2 501

Marine navigation aids. The radio direction-finder and the gyro-compass. PRICE, E. H., AND GILLULE, W. J. *Elect. Commun.*, 22, 1, *pp.* 56–69, 1944.—[Abstr. 544 B (1945)].

531.43 : 621.822.7/.8 502

Friction of ball and roller bearings. ROSENFELD, L. *Pwr Transm.*, *pp.* 991–1003, *Nov.*, 1944. *See also Engineering*, 158, *pp.* 257–258, *Sept.* 29, *and pp.* 278–279, *Oct.* 6, 1944.—Abstr. 572 B (1945)].

531.51 : 530.12 *see Abstr.* 487, 488

531.73 : 532.13 : 541.182.02 *see Abstr.* 695

531.75 503

Anti-vibration table. *J. Sci. Instrum.*, 21, *p.* 202, *Nov.*, 1944.

531.754 : 541.23 504

Density of potassium chloride. HUTCHISON, D. A. *Phys. Rev.*, 66, *pp.* 144–148, *Sept.* 1 *and* 15, 1944.—The density of KCl was determined by the method of crystal suspension in a liquid mixture of bromoform, *n*-hexanol, and *n*-pentanol. The density of the liquid mixture at the average suspension temperature of 53 different crystals was taken as the density. The value determined was:

$$\rho_{28\cdot098°C.} = 1\cdot98651 \pm 0\cdot00002)\text{g./ml.}$$

which, when corrected to 25°C., gave:

$$\rho_{25°C.} = (1\cdot98721 \pm 0\cdot00002)\text{g./ml.}$$
$$= (1\cdot98715 \pm 0\cdot00002)\text{g./cm.}^2$$

Exposure of crystals to the atmosphere produces surface contamination which resulted in a change of density by 7×10^{-4} g./ml. within 2 hr. Storage of crystals over P_2O_5 under vacuum eliminated this effect. An annealing of crystals for 4 hr. at 50° below m.p. with gradual cooling over 4 hr. was necessary to obtain agreement of suspension temperatures among different crystals. By combination of density and X-ray data, atomic weights are calculated. The values of the atomic weights of F and Ca were $18\cdot9967 \pm 0\cdot0010$ and $40\cdot0851 \pm 0\cdot0011$, respectively.

531.765 : 621.317.39 505

Multiple circuit timing unit. *Industr. Equipm. News*, 12, *p.* 26, *Feb.*, 1944. *Abstr. in Biol. Abstr.*, 18, *Abstr.* 10087, *July*, 1944.—[Abstr. 403 B (1945)].

531.767 : 629.135 : 533.6.011.4 *see Abstr.* 526

531.768 506

The three-component accelerometer. SHRADER, J. E. *J. Franklin Inst.*, 234, *pp.* 549–566, *Dec.*, 1942.—3 elements are mounted mutually at rt. angles, each comprising a cantilever pendulum adjusted to a natural frequency remote from that to be measured. Air damping is provided. Motion is indicated optically on a screen and also recorded photographically on film. Calibration may be done by (1) gravity, (2) static deflection and (3) dynamic calibration. Records are comparative and the instrument has been used for road, rail and air transport comfort measurements. E. H. W. B.

531.768 507

The bellows accelerometer. SHRADER, J. E. *J. Franklin Inst.*, 236, *pp.* 353–362, *Oct.*, 1943.—A single element comprises a metallic bellows system in which is carried fixed weights and an axial spindle. The natural frequency is dependent on the stiffness of the bellows and on the weights. The bellows have an adjustable valve and so constitute the damping element also. Recording may be direct, by a stylus on a drum, or remote, by a tilting mirror with a lamp and photocell. Means of calibration are given. If required, 2 such elements may be mounted at rt. angles to show 2 components. E. H. W. B.

531.788.7 : 621.317.39 508

Indicating and recording electronic high-vacuum gauge. *Industr. Equipm. News*, 12, *p.* 98, *Jan.*, 1944. *Abstr. in Biol. Abstr.*, 18, *Abstr.* 10085, *July*, 1944.—[Abstr. 404 B (1945)].

532.13 509

The viscosity of hydrogen fluoride. SIMONS, J. H. AND DRESDNER, R. D. *J. Amer. Chem. Soc.*, 66, *pp.* 1070–1072, *July*, 1944.—Details of a copper capillary-flow viscosimeter suitable for determining the viscosity of HF between −70° and 10°. The viscosity has low values (approx. the same as Et_2O in the same temp. range) which are raised greatly by small amounts of EtOH. W. R. A.

532.13 : 531.73 : 541.182.02 *see Abstr.* 695

532.133 510

Viscosities of pectin solutions. OWENS, H. S., LOTZKAR, H., MERRILL, R. C., AND PETERSON, M. *J. Amer. Chem. Soc.*, 66, *pp.* 1178–1182, *July*, 1944.—The relative viscosity of pectin (I) solutions varies with conc. similarly to other ionizable hydrophilic colloids. In dil. solutions the viscosity increases to

max. at *p*H 6 but can be reduced to a min. by ding NaCl or an acid, but $CO(NH_2)_2$ has little ect. As [(I)] is increased to >0·5%, the relative scosity is unaltered by *p*H between 1 and 7. The scosity/conc. curve follows the Arrhenius equation <0·1% pectin, when *p*H is 1 or 2 or when <0·9% aCl is present. This enables calculation of values intrinsic viscosity which may have some relation- ip to mol. wt. The viscosity/conc. curves for ctinates of Na^+, Me_3NH^+, ethylenediammonium, 2-dihydroxymethylpropylammonium and Et_4N^+ ns, are practically identical. Temperature (0–50°) s little effect for solutions containing <0·05% ctin, but above 0·05% the viscosity decreases with ing temperature. W. R. A.

532.133 : 532.14 : 541.68 511

Viscosities and rheochors of aldehydes, nitriles and secondary and tertiary amines. FRIEND, J. N., AND ARGREAVES, W. D. *Phil. Mag.*, 35, *pp.* 619–631, *Sept.*, 1944.—A continuation of previous papers [Abstr. 1040 (1944)]. The viscosities were determined to the b.p. and the rheochors of CN, NH and (—1) were found to be 33·0, 13·6 and 6·6 respectively. The substances investigated are:

I. (Aldehydes) CH_3CHO, $(CH_3CHO)_3$, CCl_3CHO, C_2H_5CHO, nC_3H_7CHO, *iso* C_4H_9CHO.

II. (Nitriles) HCN, CH_3CN, nC_2H_5CN, nC_3H_7CN, C_4H_9CN, $nC_5H_{11}CN$, $CH_2CN.COOC_2H_5$, C_6H_5CN, $C_6H_5CH_2CN$.

III. (Secondary amines) $(C_2H_5)_2NH$, $n(C_3H_7)_2NH$, $(C_4H_9)_2NH$, $C_6H_5NH.CH_3$, $C_5H_{10}NH$.

IV. (Tertiary amines) $(C_2H_5)_3N$, $C_6H_5N(CH_3)_2$, $C_6H_5N(CH_3)C_2H_5$, $C_6H_5N(C_2H_5)_2$, $CH_3C_6H_4N(CH_3)_2$ *ortho* and *para*, $CH_3C_6H_4N(C_2H_5)_2$ *meta*. L. S. G.

532.133 : 541.182.043 *see Abstr.* 696

532.14 : 541.133.08 *see Abstr.* 680

532.14 : 541.68 : 532.133 *see Abstr.* 511

532.517.2 : 532.68 512

The flow of liquids through thin cracks. WENTORTH, C. K. *Amer. J. Sci.*, 242, *pp.* 478–495, *Sept.*, 1944.—Using thin cracks in the form of a space between two nearly plane-parallel walls, it is shown that the flow of liquids (tap water, distilled water, benzol, solutions of borax and boric acid, xylol) through fine cracks of the order 0·1 mm. and less, decreases systematically with time and much more rapidly than the hydraulic head applied to the liquid. The flow can be reduced more than 1/1 000 fold owing, it is suggested, to the growth of adsorbed molecular films on the walls of the crack; within this range of behaviour large and significant deviations from Darcy's law occur. J. S. G. T.

532.59 : 538.65 *see Abstr.* 637

532.62 513

Pure and mixed monolayers of dilauryl maleate and fumarate. SHERESHEFSKY, J. L., AND WALL, A. A. *J. Amer. Chem. Soc.*, 66, *pp.* 1072–1076, *July*, 1944.—The surface pressure/area relationships were determined for dilauryl maleate and fumarate films at different temperatures and for the mixed esters at 25°. The consts. in the Langmuir equation of state of duplex films for these substances are evaluated. The area constants agree with X-ray dimensions of maleic and fumaric acids. The relation between the value of the dipole moment of the head group and the tendency of forming expanded films, and the relation between stability and surface potentials, are discussed. Raoult's law can be applied to the pressure of head groups in mixed duplex films. W. R. A.

532.62 : 532.7 *see Abstr.* 516

532.62 : 536.423.4 : 535.43 *see Abstr.* 580

532.64 : 536.658 514

Contact angles and adsorption on solid surfaces. LIVINGSTON, H. K. *J. Phys. Chem.*, 48, *pp.* 120–124, *May*, 1944.—It is shown that for most two-component solid-liquid-vapour systems, the contact angle is zero and the solid surface is completely covered with adsorbed mols. from the vapour at saturation pressure. This accords with the equation of Doss and Rao, $\cos\theta = 2\sigma - 1$. There are no experimental data with which to compare this equation when $\theta > 0$ or $\sigma < 1$. N. M. B.

532.68 : 532.517.2 *see Abstr.* 512

532.69 : 536.423.4 *see Abstr.* 585

532.696.1 515

Wettability of porous surfaces. CASSIE, A. B. D., AND BAXTER, S. *Trans. Faraday Soc.*, 40, *pp.* 546–551, *Dec.*, 1944.—The analysis of apparent contact angles for rough surfaces is extended to porous surfaces, particularly those encountered in natural and artificial clothing. Formulae are derived for the apparent contact angles, and experimental data confirming the formulae are given. Water-repellent clothing structures are discussed by means of this analysis, and it is shown that the water-repellency of the duck is due to the structure of its feathers rather than to any exceptional proofing agent.

532.7 : 532.62 516

On the equation of state of monolayers. JAFFÉ, G. *Phys. Rev.*, 66, *pp.* 131–138, *Sept.* 1 *and* 15, 1944.—The equation of state of monolayers is worked out from the same point of view as the statistical theory of liquids previously given [Abstr. 2157 (1943)]. The formulae should be applicable to gaseous and to condensed films, though not to the domain of transition between the two, since a change in the potential must be supposed to occur. The resulting formulae are compared with 2 groups of observations of gaseous films: (1) diesters which form insoluble films where the surface pressure has been observed directly, (2) adsorbed films of fatty acids where the surface pressure has been deduced indirectly from measurements of the surface tension. The agreement is satisfactory in both groups. For condensed films, the potential can be determined in such a way that the density and the surface v.p. (where this is known) come out correctly. The compressibility is then of the right order of magnitude.

532.713 : 536.7 *see Abstr.* 597

532.72 517

A theory of membrane permeability: I. BLOCH, I. *Bull. Math. Biophys.*, 6, *pp.* 85–92, *Sept.*, 1944.—A plane membrane is considered as a potential barrier for the molecules diffusing through it. Some simple assumptions are made about the form of the potential barrier and the differential equation describing the diffusion is set up and integrated. The membrane

permeability is determined in the case of a potential function which is constant within the membrane and zero outside. L. S. G.

532.739.2 518

Solvent selectivity for hydrocarbons measured by critical solution temperature. FRANCIS, A. W. *Industr. Engng Chem.*, 36, *pp.* 764–771, *Aug.*, 1944.—Critical solution temperatures were determined for over 100 solvents of various types with 10 representative hydrocarbons, 2 straight-chain paraffins, a branched-chain paraffin, 2 olefins, 2 naphthenes, paraffin wax, and 2 commercial oils. The difference in c.s.t. for the same solvent with different hydrocarbons is taken as a measure of the relative affinity or selectivity of the solvent for the two types of hydrocarbon. Selectivities for olefins, naphthenes, branched chains, types of oil, and mol. wt are calculated and plotted against each other to show their extent of interrelation. Effects of substituent groups in the solvents are estimated. The methyl and phenyl groups usually lower c.s.t. about 40°C. The nitro and carboxyl groups raise it over 100°C.

532.74 519

Molecular association in oxyacids. RAO, N. R. *Indian J. Phys.*, 17, *pp.* 326–331, *Dec.*, 1943.—Molecular association in solutions of oxyacids is studied with the help of Raman effect. On comparing the associating nature of these substances with their strength, it is found that the stronger the acid, the smaller is the tendency for its molecules to polymerize. A comparative study of molecular association in solutions of acetic and chloracetic acids, which are known to be of increasing order of strength but of similar structure, is made and the above point is confirmed. Increase in *p*H in these solutions will have the effect of diminishing the molecular association, contrary to what is to be expected from the law of mass action.

532.77 520

Dimerization in perfect solutions. Analysis of data of Brown and Bury. WYNNE-JONES, W. F. K., AND RUSHBROOKE, G. S. *Trans. Faraday Soc.*, 40, *pp.* 345–352, *Sept.*, 1944.—The cryoscopic measurements of Brown and Bury in 1926 for certain organic solutions are re-interpreted. The deviations from perfect (ideal) behaviour of the solutions are considered in terms of dimerization of the solutes; a new formula involving the activity coeffs of the solutes is proposed, and a comparison of the old and new results shows that dimerization probably accounts for the main part of the cryoscopic effects. N. M. B.

532.77 : 541.24 521

Determination of molecular weights by the cryoscopic method. SIMPSON, W. *Nature, Lond.*, 154, *pp.* 705–706, *Dec.* 2, 1944.

532.782 : 539.219.1 : 536.658 522

Sorption by gmelinite and mordenite. BARRER, R. M. *Trans. Faraday Soc.*, 40, *pp.* 555–564, *Dec.*, 1944.—Mordenite and gmelinite possess characteristic sorptive properties towards non-polar as well as polar molecules. The molecular sieve properties of mordenite differ from those of other zeolites so far studied; those of gmelinite recall the behaviour of chabazite. The minerals act as absorbents by forming with suitable solutes a type of interstitial solid solution in which only physical forces are involved. High-temperature base exchange of mordenite, producing Ca- and Ba-mordenites, resulted in notable changes in sorptive properties. The affinity of O_2 and N_2 for the dehydrated crystal lattices, and the heats of occlusion, were in the order natural mordenite < Ba-mordenite < Ca-mordenite, and were greater for N_2 than for O_2.

532.785 523

Crystallization of binary and commercial soap systems. FERGUSON, R. H., AND NORDSIECK, H. *Industr. Engng Chem.*, 36, *pp.* 748–752, *Aug.*, 1944.—Fractionation into the constituent single soaps is completely absent when anhydrous binary systems crystallize from isotropic melt. Fractional crystallization may occur when there is a sufficient difference in chain length between the two components, but even here the fractions are solid-solution phases and not pure components. It appears to be the general rule that commercial soap crystallizes as a solid solution. No evidence of fractional crystallization has been observed in commercial soap.

533.42 524

The application of the barometer in physics and chemistry. SATTERLY, J. *J.R. Astr. Soc. Can.*, 38, *pp.* 21–30, *Jan.*, 1944.—Attention is drawn to errors commonly made in experimental work involving the use of the barometer. Pressures quoted in mm. Hg cannot be turned into millibars by means of a universal relation: the local value of *g* should be quoted. B.p. determinations should be made at known barometric pressure; buoyancy corrections in weighing operations involve barometer readings; and in the determination of *g* by pendulum measurements similar buoyancy corrections are needed. Errors in the actual readings of a barometer may be due to imperfect vacuum, to impure Hg, to errors in catheto-metry and in the corrections assumed for the capillary depression and the temperature effect. A numerical example illustrates the points made. A. HU

533.56 525

Some measurements of ultimate vacuum and pump speed of molecular pumps. II. EKLUND, S. *Ark. Mat. Astr. Fys.*, 29*A*, 1, *No.* 4, 9 *pp.*, 1943.—The author investigates the characteristics of 2 molecular pumps of the disc type, larger than those previously used [Abstr. 581 (1944)] and with somewhat different grooves. The pressures attained were measured with an ionization manometer and a McLeod gauge. Ultimate vacua of 2 or 3 × 10^{-6} mm. Hg are attained and speeds of about 60 l./sec. are maintained, constant to within 30% in the range 10^{-2} to 10^{-4} mm. Hg. The pumps are therefore useful for rapid evacuation though their speeds drop near their ultimate vacuum. The effect of fore pressure is negligible up to about 5 mm. A linear relation exists betw. pumping speed and the rotational speed of the disc. A. HU

533.6.011.4 : 531.767 : 629.135 526

Safe aircraft top speeds. *Aviation*, *pp.* 128–129, *Sept.*, 1944.—When the relative speed of air at any area on an aerodynamic surface exceeds the local speed of sound, a discontinuity occurs with resultant incidence of shock waves on the wings and tail. The controls lose their effectiveness owing to re-distribution of pressures over the aerofoil, and

uctural damage may be caused. The principles of eration and mathematical theory are discussed for instrument measuring the safe max. speed of an craft approaching the speed of sound. M.-V.

4.013 527

Torsional vibration of multi-disc systems. FISHER, *J. Appl. Phys.*, 15, *pp.* 676–677, *Sept.*, 1944.—An ymptotic method is given for computing the lowest quencies. It is based on the assumption that the quency may be represented approx. by a descending ries in the disc number and that the leading term of e series can be obtained by inspection of the quency equation. Three examples are given. ese relate to 6-cylinder Diesel engines. L. S. G.

4.013 : 539.414 528

Forced torsional oscillations of an elastic half-space. REISSNER, E., AND SAGOCI, H. F. *J. Appl. ys.*, 15, *pp.* 652–662, *Sept.*, 1944.—The half-space, is homogeneous and isotropic; the stresses and splacements in S are found when periodic shear esses are applied to a circular portion of the surface S causing it to rotate through an angle Φ. This is mixed boundary problem, and an explicit solution obtained by the use of a system of oblate spheroidal -ordinates which serve to separate the variables in e differential equation of motion. The solution in e static case ($\partial\Phi/\partial t=0$) is obtained and those oscilla- ns are studied which are set up when Φ varies usoidally with time. For this purpose the physical nstants of the material are assumed known, but the thod also permits the determination of the shear- odulus from a study of the torsional oscillations. L. S. G.

4.1 529

Mechanical vibrations: their cause and prevention. GLIS, C. E. *J. Instn Civ. Engrs*, 22, *pp.* 312–357, *ct.*, 1944. *Engineer, Lond.*, 177, *pp.* 489–490, *une* 23, 1944.—The paper treats of the harmonic alysis and generation of vibrations, and it is shown at the natural frequency of a structure is the best iterion of its stability. Oscillations in railway hicles are due to sleepers and to rail-joints; the epers should not be placed at uniform distances, d rail-joint impact is reduced at high train speeds. brations in railway bridges are caused by the hammer- ows set up by the balance weights on the driving heels of locomotives. The torsional oscillations of ank-shafts are those in which the flywheel and the opeller oscillate in opposite directions. Resonance ay be caused by an upper harmonic of the crank fort but the action of water causes considerable mping. Oscillations of a non-isochronous spring e such that resonance cannot be established by a sturbance of constant periodicity. Self-excited cillations are due to negative damping which causes e screeching of a brake-block, squeaking of an dubricated hinge and the note of a bowed fiddle- ing. The "galloping wire" is seen in long-span ower lines under the action of wind when the wire is a deposit of ice on the lee side. With vertical otion the relative velocity of a horizontal wind sets a pressure difference which assists the motion hether down or up. Some methods of counter- ting vibrations are referred to; mathematical proofs e given. G. E. A.

534.1 : 548.0 530

Free vibrations of anisotropic bodies. EKSTEIN, H. *Phys. Rev.*, 66, *pp.* 108–118, *Sept.* 1 *and* 15, 1944.—Approx. solutions for free vibrations of a finite anisotropic body are derived by a perturbation method. As an example, some extensional modes of thin crystal plates are calculated. Calculated frequencies and deformation patterns are compared with observations.

534.113 531

On the tones of thin cylindrical tubes. ALLAN, G. E. *Phil. Mag.*, 35, *pp.* 571–582, *Sept.*, 1944.—Three types of vibrations are considered, (1) lateral, (2) peripheral and (3) longitudinal. The theory of these vibrations is referred to and experiments are described which show good agreement with the theory. These experiments are carried out with the aid of thin brass tubes. Some acoustical applications of metal tubes are noted. L. S. G.

534.121.2 532

The effect of radiation on the vibrations of a circular diaphragm. LAX, M. *J. Acoust. Soc. Amer.*, 16, *pp.* 5–13, *July*, 1944.—The vibrations of a clamped circular plate in an infinite baffle with a fluid on one side are solved in terms of the radiation impedances associated with the normal modes of a plate vibrating in a vacuum. The influence of the fluid on the motion of the plate depends on the dimensions of the plate and the relative densities of fluid and plate. The procedure may be applied to plates with nodal diameters, membranes and strings. G. E. A.

534.154 : 621–752 533

Vibration protection for rotating machinery. WEBB, R. L., AND MURRAY, C. S. *Trans. Amer. Inst. Elect. Engrs*, 63, *pp.* 534–537, *July*, 1944.—[Abstr. 278 B (1945)].

534.2 : 534.321.9 *see Abstr.* 538

534.213 : 534.321.9 534

Supersonic transmission at oblique incidence through a solid plate in water. SMYTH, J. B., AND LINDSAY, R. B. *J. Acoust. Soc. Amer.*, 16, *pp.* 20–25, *July*, 1944.—The selective transmission of oblique supersonic waves through a glass plate in water was studied over the frequency range 1 to 3 Mc/s. The cases tested were for angles of incidence (*a*) less than the critical angles for both dilatational and shear waves, (*b*) between the 2 critical angles, and (*c*) greater than both these angles. Good agreement was obtained between the measured transmission and the theoretical values. Supersonic transmission through a glass-water filter was also studied, and Bragg's law of selective reflection was verified experimentally. G. E. A.

534.213.4 535

The reflection of sound due to a change in cross-section of a circular tube. MILES, J. *J. Acoust. Soc. Amer.*, 16, *pp.* 14–19, *July*, 1944.—Previous theory, good at l.f., breaks down at h.f. The theory developed here is valid for any frequency in an ideal fluid: the exact pressure distribution is calculated in the vicinity of the discontinuity. G. E. A.

534.213.4 536

Propagation of sound in lined ducts. MOLLOY, C. T. *J. Acoust. Soc. Amer.*, 16, *pp.* 31–37, *July*, 1944.—Approximate methods are developed to simplify the

solution of practical problems of the above type. The methods represent deductions based on Sivian's theory [Abstr. 5046 (1937)]. The approx. formulae for the calculation of attenuation rates in ducts are tabulated and graphed. G. E. A.

534.22 : 536.633 : 534.321.9 *see Abstr.* 539

534.3 537

Some problems for post-war musical acoustics. YOUNG, R. W. *J. Acoust. Soc. Amer.*, 16, *pp.* 103–107, *Oct.*, 1944.—An inquiry to estimate the need for a committee of the Acoust. Soc. Amer. for the study of problems such as basic studies, criteria and standards, and new instruments both for playing and for measurements. G. E. A.

534.321.9 : 534.2 538

Ultrasonics. COCHRAN, D., AND SAMSEL, R. W. *Gen. Elect. Rev.*, 47, *pp.* 39–41, *Aug.*, 1944.—A method is described for determining the acoustic velocity and absorption in materials to be used as ultrasonic windows, lenses and reflectors. A 3° wedge of plastic is interposed across a narrow ultrasonic beam passing through water and measured by a receiver. For a wedge of polystyrene was found: density 1·06 gm./cm.^{3}, velocity $2{\cdot}35 \times 10^5$ cm./sec., and absorption 1·2 db/cm. at 750 kc/s. G. E. A.

534.321.9 : 534.213 *see Abstr.* 534

534.321.9 : 534.22 : 536.633 = 4 539

On the velocity of propagation of sound in air, and in a nitrogen-hydrogen mixture, at low temperatures. Calculation of the specific heats. VAN ITTERBECK, A. AND VANDONINCK, W. *Ann. Phys., Paris*, 19, *pp.* 88–104, *Jan.–March*, 1944.—An ultrasonic experimental method is used. The acoustic interferometer and its associated electric circuit, and the apparatus for preparing the H_2–N_2 mixture, are described. A theoretical method is given, based on the equation of state $pv = RT(1 + B/v + C/v^2 + \ldots)$. It is shown that the velocity of propagation (W) is given by the linear relation $W = W_0(1 + sp)$ where W_0 is a function of t and

$$s = B/R + \frac{1}{\lambda R}\frac{dB}{dT} + \frac{1}{2\lambda(\lambda+1)}\frac{T}{R}\frac{d^2B}{dT^2}$$

Numerical results (experimental and theoretical) are presented in graphical and tabular form. For air, the velocity was measured between 79·15° and 90·10° abs. (obtained by means of liquid oxygen) at varying pressures from 0·085–0·941 atm. The coefficient, B, for air is plotted as a function of T and numerical values of W_0 are given. The specific heats for air are given as function of the pressure for $T = 90°$ abs. and $T = 80°$ abs. Similar results are given for H_2–N_2. L. S. G.

534.414 540

The Rayleigh disc as a laboratory instrument. ROSEBERRY, H. H., AND SMITH, W. C. *J. Acoust. Soc. Amer.*, 16, *pp.* 123–125, *Oct.*, 1944.—Suggestion of an experiment not too elaborate for scholastic use. A large 1½-litre can was fitted with adjustable side-tubes, in front of which a disc could be placed made of a suspended cover-glass. A source of sound of variable frequency and a funnel for adding water to the can were used. The resonant frequencies observed were verified by means of the equivalent values for capacitance and inductance. G. E. A.

534.6 : 534.75 54

Investigations on the microphone effect of the cochl with some remarks on a new technique. JUUL, *Acta Physiol. Scand.*, 7, *pp.* 261–270, *April*, 1944. The anode used was a freshly chloridized silver wi applied directly to the apex of the cochlea. Tl microphone effect on guinea-pigs comprises a fr quency range of about 30 to 14 500 c/s. The electric audiogram taken on guinea-pigs corresponds close to the normal audiogram of human beings. Tl microphone effect must be regarded as a link wi the perception of sound. C. J.

534.647 : 550.341 54

On the theory of seismometers. PENDSE, C. *Phil. Mag.*, 35, *pp.* 706–713, *Oct.*, 1944.—The exa general equation of motion of a seismometer obtained, an important particular case being

$$\ddot{\psi} + 2A\dot{\psi} + (n^2 + H\sin pt)\psi = BA_y \sin pt.$$

The particular integral and complementary functic of this equation are found and the equation is solv as far as the first order of the acceleration term The results obtained are discussed in relation to seism meters and seismograms and it is shown that resonan periods other than the free period of the instrume may exist. An alternative form for the ground motic is considered. L. S.

534.75 : 534.6 *see Abstr.* 541

534.75 : 612.85 54

Anatomical changes responsible for blast deafne and the prevention of such damage to the ear. GUIL S. R. *J. Acoust. Soc. Amer.*, 16, *pp.* 68–70, *Jul* 1944.—The single pulse of increasing pressure is t cause of observed injuries to the middle and inner ea namely the rupture of the tympanic membrane ar destruction of the hair cells of the organ of Cor The usual effect caused by the injury is deafness higher tones and often an annoying tinnitus. Tl simplest method of protection is to place a finger t firmly over the ear opening. Solid obturators for th same purpose are also effective; their use for milita purposes is discussed. G. E.

534.773 54

Acoustical amplification by hearing-aids. SABIN P. E. *J. Acoust. Soc. Amer.*, 16, *pp.* 38–44, *Jul* 1944.—Apparatus and procedure are described t which the amplification afforded by the hearing-a is balanced by attenuation inserted in the output a measuring microphone. Acoustic conditions in th test booth remained unaltered between measuremen made with a standard transmitter alone and those wit the hearing-aid and a coupler interposed. The resul of tests on 6 vacuum-tube aids suggest that in standardized procedure the input levels should b specified and should be below the overload level the instrument. G. E.

534.773 54

Practical hearing-aid measurements. CARLISL R. W., AND MUNDEL, A. B. *J. Acoust. Soc. Amer* 16, *pp.* 45–51, *July*, *Erratum*, *p.* 125, *Oct.*, 1944. The constructional details of a soundproof boo with a sound-source and artificial body, ear ar mastoid for bone conduction, are given. Acoust overload is avoided by using an oscilloscope for co tinuous inspection of the output wave form. Th

ificial body is made up to simulate the average man body, the need for such an equipment having en demonstrated. G. E. A.

4.773 546

The baffle effect of the human body on the response a hearing-aid. HANSON, W. W. *J. Acoust. Soc. er.*, 16, *pp.* 60–62, *July*, 1944.—The effective ponse of a hearing-aid when worn by a person ing the source of sound is, generally, to enhance l.f. by about 5 db whilst the h.f. is reduced or not atly enhanced. The variability of the response ies the adoption of a single standard correction ve; more extensive investigation is necessary. G. E. A.

4.773 547

Pressure and field response of the ear in hearing-aid formance determination. LEBEL, C. J. *J. Acoust. . Amer.*, 16, *pp.* 63–67, *July*, 1944.—Deals with difference in response of the ear when free and en covered with a hearing-aid, and with the ference in action of a hearing-aid transmitter when a human ear and when on an artificial ear to asure its characteristics. The errors in the two es are found and related to the results of normally plied measuring procedure by the use of correction tors. G. E. A.

4.773 548

A clinical comparison of air- and bone-conduction aring-aids in cases of conductive impairment of aring. SILVERMAN, S. R. *J. Acoust. Soc. Amer.*, 16, 108–112, *Oct.*, 1944.—Reports tests on 73 cases which there was normal or slightly decreased bone nduction, negative Rinne and normal or retracted mpanic membrane. A greater number of cases heard ter by air conduction, fewer heard better by bone nduction, and still fewer heard equally well by both thods. The evaluation of a hearing-aid must pend on the responses of the individual patient. G. E. A.

4.773 : 534.833 549

Acoustic sound filtration and hearing-aids. GROSS-N, F. M., AND MOLLOY, C. T. *J. Acoust. Soc. ier.*, 16, *pp.* 52–59, *July*, 1944.—An experimental d analytical study of the influence of the short tube ich connects the receiver of a hearing-aid to the . The tube is usually moulded from lucite and is rtly responsible for the weak h.f. output of hearing-is. Curves show the difference in the response of eceiver connected, first to different moulds alone, d then to the moulds with insertion of a high-pass er. G. E. A.

4.773 : 621.395.61 550

Electrical hearing-aids. LITTLER, T. S. *J. Instn ect. Engrs*, 91, *Part III, pp.* 67–74, *and* 79–83, ne, 1944.—[Abstr. 509 B (1945)].

4.773 : 621.395.61 551

A basis for the prediction of performance of hearing-is. BALBI, C. M. R. *J. Instn Elect. Engrs*, 91, rt III, *pp.* 74–83; *June*, 1944.—[See Abstr. 508 B 945)].

4.833 : 534.773 *see Abstr.* 549

4.843 552

Acoustics of small rooms. MOIR, J. *Wireless orld*, 50, *pp.* 322–327, *Nov.*, 1944.—The principles enunciated by Sabine are reviewed briefly, and the importance of the reverberation time is stressed. The measurement of the optimum reverberation time for a small room of which the plan and dimensions are given is well below the theoretical value. Vibrations of the room structure may be absorbed by internal friction and by resonance, and resonance may play an important part in determining the quality of reproduction in the room. Sound quality in small rooms is determined by important factors additional to those responsible in large rooms. Accurate reproduction of l.f. notes appears impossible in small rooms, and sound quality in a small room may be good, but never in the same sense as in a large room. G. E. A.

535.14 : 530.145.65 = 4 *see Abstr.* 495

535.21 : 614.71 *see Abstr.* 742

535.215 : 539.261 : 537.531.8 = 4 *see Abstr.* 613

535.215.1 : 537.531 : 537.533.8 *see Abstr.* 620

535.23 : 537.533.8 *see Abstr.* 619

535.24 : 612.84 : 628.9 553

Experiments illustrating the production and nature of light, photometry, the fundamental principles of illuminating engineering, and the advantages of good lighting. *Trans. Illum. Engng Soc., Lond.*, 9, *pp.* 133–147, *Sept.*, 1944.—[Abstr. 581 B (1945)].

535.241.44 : 628.9 554

Brightness and helios. MOON, P., AND SPENCER, D. E. *Illum. Engng, N.Y.*, 39, *pp.* 507–520, *Sept.*, 1944.—[Abstr. 583 B (1945)].

535.241.44 : 628.9 555

Brightness units. REINHARDT, H. *Illum. Engng, N.Y.*, 39, *pp.* 521–533, *Sept.*, 1944.—[Abstr. 582 B (1945)].

535.243 : 577.16A 556

Destructive irradiation technique of spectrophotometric vitamin A assay. LITTLE, R. W. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *pp.* 288–293, *May*, 1944.—Experiments described for fish liver oils and preparations of animal tissues over a wide range of potency show that three assumptions on which the validity of the method depends are fulfilled: the irradiation process destroys vitamin A, the end product of the destruction having no appreciable absorption at 3 280 Å; substances present other than vitamin A undergo no appreciable change in their absorption at 3 280 Å during the irradiation; the irradiation causes quantitative destruction of the vitamin present. N. M. B.

535.243-31 557

A simple adaptation of the ultra-violet photographic spectrophotometer to direct visual measurement. STRAIT, A. L., KUMLER, W. D., AND GOYAN, F. M. *Proc. Amer. Phys. Soc., Berkeley, Cal., July* 22, 1944. *Abstr. in Phys. Rev.*, 66, *p.* 160, *Sept.* 1 *and* 15, 1944.—The conventional ultra-violet photographic spectrophotometer of the rotating-sector or stationary variable-diaphragm type is adapted to direct visual measurement by substituting a fluorescent screen for the photographic plate. Monochromatic measurement of optical density or transmission may be made with speed comparable to conventional photo-electric photometers and there is an advantage in flexibility

with regard to type and size of sample which may be measured. K_2CrO_4 solutions ranging in optical density at 2 800 Å from 0·04 to 1·3 were used, and the duplicate-measured transmission values deviate from the theoretical by a max. of 3%, mean deviation 1·6%. A suitable screen may be made by depositing a uniformly fine suspension of anthracene (in cellulose acetate or butvar) on a glass screen.

535.244 : 522.617.3 : 535.247.4 *see Abstr.* 558

535.247.4 : 535.244 : 522.617.3 558

On some applications of the flicker method in photo-electric measurements. ÖHMAN, Y. *Ark. Mat. Astr. Fys.*, 29*B*, 4, *No.* 12, 7 *pp.*, 1943.—The general principles are given of a photo-electric photometer for use with the flicker method. The detector is a multiplier photocell used in conjunction with an a.c. voltmeter which responds only to current of a particular frequency, thus eliminating dark-current effects. A sector which may contain different colour filters or polarizers is rotated at the appropriate speed in the incident beam. The device is applied to a polarimeter in which a rotating polarizer is backed by the photocell and the selective voltmeter is used as a null-point detector. The amount and the plane of polarization of the incident beam are found from a celluloid compensator of variable inclination. Applications to the measurement of rotatory power and of stellar colour indices are described. A. HU.

535.312 : 548.0 : 537.531 *see Abstr.* 610

535.315 559

Criteria for resolution and the resolving power of absorbing prisms. CROSS, P. C., AND NIXON, E. R. *J. Opt. Soc. Amer.*, 34, *pp.* 517–520, *Sept.*, 1944.—Details are given of a method by means of which the limiting resolving power of any prism may be determined. The limit of resolution is redefined as the min. angular separation of the central max. of the individual diffraction images at which there may exist a min. of total intensity between the positions of the individual central max. The application to a 10 cm. rocksalt prism is discussed. A. H.

535.315 : 535.415 *see Abstr.* 578

535.323 : 541.486 = 3 560

Refractometric investigations on three systems of aluminium nitrate and sodium-acetate, tartrate and citrate. SPACU, G., AND POPPER, E. *Kolloidzschr.*, 103, *pp.* 19–24, *April*, 1943.—If an Al salt is treated with excess Na-acetate, a multi-cored complex is formed similar to that of Cr and Fe. The formation of this complex explains why Al-hydroxide cannot be precipitated by OH-ions in the presence of Na-acetate. Similar multi-cored complexes are formed with Na-tartrate and the Na-citrate. R. N.

535.33.03 561

Reducing electrical interference from spectrographic spark source. LANDEN, E. W. *J. Opt. Soc. Amer.*, 34, *p.* 532, *Sept.*, 1944.—Where a vacuum photocell and amplifier are used to measure photographic density in a spectrographic laboratory, simultaneous use of an interrupted h.v. spark as a source may be impossible. Use of a screen gauze below the sample holder, or a copper ring around the electrode, completely eliminates disturbance. A. H.

535.33.03 5

An arc source for ultra-violet absorption spect
scopy. O'CONNOR, R. T., AND JEFFERSON, M. *J. Opt. Soc. Amer.*, 34, *pp.* 540–542, *Sept.*, 1944. A h.v., a.c. arc using impregnated carbon electrod is recommended as source. It is claimed that su a source is steady, uniform and of high intrin brightness. A.

535.33.03 5

A useful tool for shaping spectrographic graph electrodes. EASTMOND, E. J. *J. Opt. Soc. Amer.*, pp. 621–622, *Oct.*, 1944.

535.338 : 537.531 : 537.533.8 *see Abstr.* 621, 622

535.338 = 3 5

Position of the terms $1s_3$ and $1s_2$ and magnitude the limit splitting in the spectrum of radon, R EDLÉN, B. *Ark. Mat. Astr. Fys.*, 29*A*, 3, *No.* 2 10 *pp.*, 1943.—Terms previously attributed to and $1s_2$ are shown to be better classified as $3d_6$ a $3d_5$, respectively. From the observed quantu defects of terms in the series md_6 and md_5 ($4 < m <$ approx. values for $1s_3$ and $1s_2$ are calculated. Co parison of the configurations $np^5(n+1)s$ in the oth inert gases shows approx. const. electrostatic int action betw. $n's$ and the remainder of the atom, b spin-orbital interactions increasing rapidly wi nuclear charge and a simultaneous approach to coupling. From comparisons of the splitting $np^5\,^2P$ along the sequence of inert gases the ratio of t effective nuclear charge $(z-\sigma)$ to the atomic nu ber (z) is derived. The screening factor σ is int preted in terms of the electron configuration. A. H

535.338.3 = 3 5

Quadrupole lines in the arc spectra of the inert gase EDLÉN, B. *Ark. Mat. Astr. Fys.*, 29*A*, 4, *No.* 3 4 *pp.*, 1943.—A number of unidentified lines, son of them fairly strong, in NeI, AI, KrI and XeI a attributed to forbidden transitions of the type $1s-3$ due to spontaneous quadrupole radiation. T selection rule $\Delta J = 0,\ \pm1$ or ±2, with $0 \rightarrow$ $\frac{1}{2} \rightarrow \frac{1}{2}$ and $0 \rightleftharpoons 1$ excluded, is satisfied by the lin observed. In AI more than half the combinatio allowed have been observed. It is suggested that search amongst weak lines of complicated spect would lead to less categorical reliance on the ordina selection rules. A. H

535.338.4 5

The green bands of magnesium oxide. LAGERQVIS A. *Ark. Mat. Astr. Fys.*, 29*A*, 3, *No.* 25, 13 *pp.*, 1943. High-dispersion spectrograms of an arc betw. M electrodes in O_2 at 60–80 mm. pressure are obtain in the first and second orders of a 21 ft. concav grating. A rotational analysis is given of the (0, and (1, 1) bands of the green system of MgO, an the constants of the upper and lower $(^1\Sigma)$ levels a derived. The vibrational structure of the sequenc $\Delta v = 0$ and $\Delta v = 1$ is investigated. There is n connection betw. the electronic levels in the green an red systems, though they are all $^1\Sigma$. A. H

535.338.4 5

The λ3 338 band of OD. ISHAQ, M. *Indian J. Phys* 18, *pp.* 52–56, *Feb.*, 1944.—The λ3 338 band of O was photographed in the 2nd order of a 10 ft. co cave grating. The band is similar to that of OH

428 which is attributed to a $^2\Sigma^+ \rightarrow {}^2\Pi_{inv.}$ transon. An analysis of the rotational structure is made d the values of the rotational constants are deterined and compared with those of the corresponding H band.

35.338.4 568

Influence of air-gases on the first and second positive stems of nitrogen. TAWDE, N. R., AND PATANKAR, S. *Phil. Mag.*, 35, *pp.* 600–605, *Sept.*, 1944.—An perimental study of the vibrational intensity disibution in the 1st and 2nd positive band systems pure N_2 and of air. The spectra were excited in discharge tube of the usual H-type fitted with Al ectrodes and were examined end-on through the uartz window. The pressure of the enclosed gas as adjusted to 1·2 mm. The peak intensity values r the 2 systems are given in tabular form. There a discussion of the results (e.g. the enhancement of rtain bands) and the connection with the theories of ctive nitrogen [Abstr. 1433 (1933), 3662, 3854 934)]. L. S. G.

35.338.42 : 539.133 *see Abstr.* 640

35.338.42 = 3 569

On the spectrum of HCl in the photographic infra-red. INDHOLM, E. *Ark. Mat. Astr. Fys.*, 29*B*, 4, *No.* 15, *pp.*, 1943.—Apparatus previously described [Abstr. 73 (1940)] is used to photograph HCl vibration-otation bands at 9 152 Å and at 7 463 Å with a dispersion of 1·8 Å/mm. The absorption columns ontained HCl at atmospheric pressure and were 7 m. and 54 m. long for the respective bands. Data re given for the 4—0 bands of HCl^{35} and HCl^{37} nd for the 5—0 band of HCl^{35}. New molecular onstants are derived for HCl^{35}. A. HU.

35.339 : 537.531 *see Abstr.* 611

35.342 : 541.651 570

The absorption spectra of pyrrole blue A and B. ROMM, F. *J. Amer. Chem. Soc.*, 66, *pp.* 1227–1228, *uly*, 1944.—The absorption spectra of pyrrole A nd B confirm the assumption that they possess ifferent structures. W. R. A.

35.345.6 : 537.531 *see Abstr.* 612

35.371 : 541.144 *see Abstr.* 691

35.372 : 549.211 571

Spectroscopic study of luminescence patterns in iamond. MANI, A. *Proc. Indian Acad. Sci. A*, 20, *p.* 155–161, *Sept.*, 1944.—The local variations in ntensity and colour of the fluorescent radiation from ix cleavage plates of diamond exhibiting blue, yellow nd mixed types of luminescence, were investigated pectroscopically. A close correlation exists between ne variations exhibited in the intensities of the lectronic lines at 4 152 and 5 032 and of their subidiary bands, and also between the two systems nemselves. Only the 4 152 system is shown by blue-uminescent diamonds, whilst both systems are xhibited by the yellow and mixed types. There is ome evidence for the existence of two other systems f luminescent bands associated with the electronic ines at 5 359 and 5 895 Å. W. R. A.

35.372 : 549.211 : 535.375.51 *see Abstr.* 576

35.372 : 577.16A 572

The fluorescence of vitamin A. II. Ultraviolet bsorption of irradiated vitamin A. SOBOTKA, H., KANN, S., WINTERNITZ, W., AND BRAND, E. *J. Amer. Chem. Soc.*, 66, *pp.* 1162–1164, *July*, 1944.—The highly fluorescent solution obtained by ultra-violet irradiation of vitamin A acetate, but not of the free vitamin A alcohol, in ethanol, shows 4 absorption bands at 275, 328, 345–346 and 364–365 mμ, the second of which is identical with that of vitamin A itself. This spectrum suggests the presence of more than 5 conjugated double bonds. The 3 longer wavelengths coincide with those of the absorption bands of isoanhydro vitamin A. The highly fluorescent irradiation product, while not identical with isoanhydro vitamin A, may constitute an excited form of the latter. The chromogenic power of irradiated vitamin A in the Carr–Price reaction is hardly impaired until a secondary oxidative photo-reaction leads to decrease and eventual disappearance of fluorescence. The absorption band at 275 mμ is due to a chromogenic product of a less specific, and possibly independent, oxidative degradation of vitamin A.

535.375.5 573

Influence of temperature on the Raman bands of H_2O, D_2O and HDO. RAO, I. R., AND RAO, N. R. *Indian J. Phys.*, 18, *pp.* 47–51, *Feb.*, 1944.—The experimental investigations on the structural variations with temperature, of the Raman bands of H_2O, D_2O and HDO, reveal that (1) the HDO bands are narrower and sharper than the bands due to either H_2O or D_2O, (2) at the higher temperature, the max. of the bands has a larger frequency in all cases than at the lower temperature except for D_2O, (3) the intensity of the band on the lower-frequency side diminishes with temperature in all cases, (4) the intensity on the h.f. side is greater at the higher temperature than at the lower temperature, for all the bands except for D_2O, (5) the total intensity of the HDO bands, as represented by the height of the max. or by the area of the intensity distribution curves, is less than that for the H_2O or D_2O bands. These results are explained on the basis of the polymerization of all 3 types of liquids. The difference in the structure and intensity of the HDO on the one hand and the H_2O and D_2O bands on the other is attributed to the influence of the large proportion of H_2O and D_2O present in the former case and to the probable smallness of the specific intensity of the HDO band.

535.375.5 : 536.423.15 : 536.75 : 536.6 *see Abstr.* 589

535.375.5 : 541.128 574

Optically catalytic action of anthracene and phenanthrene in giving Raman shifts of some organic compounds. SINHA, S. P. *Indian J. Phys.*, 18, *pp.* 38–46, *Feb.*, 1944.—By taking the wavelengths of the absorption bands of anthracene in benzene, methyl alcohol, hexane, toluene and chlorobenzene and those of phenanthrene in benzene and methyl alcohol, as giving the exciting frequencies, the differences between these and the frequencies of the fluorescent bands were calculated. These agree with most of the Raman frequencies of the solvents. Some shifts observed in the present case which do not agree with any known Raman shift may be built up by the combinations of Raman shifts observed. [See Abstr. 472 (1940)].

535.375.5 : 541.132 *see Abstr.* 679

535.375.51 575

Influence of temperature on the intensities of Raman lines due to some organic liquids. SIRKAR, S. C., AND

SANYAL, S. B. *Indian J. Phys.*, 17, *pp.* 309–315, *Dec.*, 1943.—The intensities of Raman lines of benzyl alcohol, benzyl amine and benzoyl chloride at the room temperature and at higher temperatures, a few deg. below the b.p. of the liquids, were measured quantitatively, using photographic spectrophotometry. In the case of the lines 610, 794 and 1 000 of benzyl alcohol and of the line 1 003 of benzoyl chloride, the intensities increase with increase of temperature in accordance with the predictions of the polarizability theory. In the case of lines of larger frequency shifts, the intensities remain almost const.

535.375.51 : 535.372 : 549.211 576

Polarization of Raman scattering and of fluorescence in diamond. MANI, A. *Proc. Indian Acad. Sci. A*, 20, *pp.* 117–121, *Sept.*, 1944.—Depolarization values for the principal Raman line in diamond were obtained with the incident light (1) unpolarized, and (2) polarized with the electric vector along the OY and (3) OZ axes. The polarization of the fluorescence bands of the 4 152 system was also investigated, the bands being polarized when the incident light is polarized, but depolarized with incident unpolarized light. The results for the depolarization of the Raman line are not in accord with the values predicted by Saxena [Abstr. 2154 (1940)] on the basis of Placzek's selection rules. W. R. A.

535.375.51 : 541.65 577

The Raman spectrum of hexamethylene-tetramine. BAI, K. S. *Proc. Indian Acad. Sci. A*, 20, *pp.* 71–76, *Aug.*, 1944.—The Raman spectrum and the polarization character of its lines have been measured for $C_6H_{12}N_4$ in saturated aq. solution. The spectrum is in good agreement with the recorded values. [*Z. Phys. Chem.*, 1938, 39B, 431.] One new line at 398 has been observed, and the lines at 1 011 (6*b*), 1 451 (5*b*) and 2 980 (3) found to be doublets. The recorded data satisfy the tetrahedral model assigned to the molecule from X-ray studies. W. R. A.

535.415 : 535.315 578

A calculation of Newton-ring tolerances for prism faces. SPEYER, E. *J. Opt. Soc. Amer.*, 34, *pp.* 529–531, *Sept.*, 1944.—The effect of certain assumptions on the calculations is discussed, particularly from the viewpoint of the limits within which the optical shop must work. A. H.

535.42 : 621.396.616 : 538.56 *see Abstr.* 634

535.421 579

Improved diffraction gratings and replicas. WOOD, R. W. *J. Opt. Soc. Amer.*, 34, *pp.* 509–516, *Sept.*, 1944.—Details are given of improvements, including the use of aluminized plates of Pyrex glass and the manner in which groove form can be controlled with this medium, the making of replicas from gratings ruled on thick Al films, the preparation of mosaic gratings, the making of bi-prism gratings and the preparation of aluminized replicas of echelette gratings. The effect on light distribution (in the various orders of grating spectra) of variation in the angle of incidence is discussed. A. H.

535.43 : 532.62 : 536.423.4 580

Transmission of light by water drops 1 to 5 μ in diameter. RUEDY, R. *Canad. J. Res. A*, 22, *pp.* 53–66, *May–July*, 1944.—The size of the drops formed when water vapour condenses is related to the wor performed against the surface tension. It can b shown theoretically that in the propagation of ligl in a medium containing small spherical drops, th intensity of the light received in the prolongation o the incident beam passes alternately through ma and min. values, and hence the light seen throug a cloud of particles with diameters $>\sim 1\ \mu$ is coloure The theory accounts for the cycles in the changes o colour observed when the diameter increases, an enables the radius of the growing drops to be dete mined. N. M. I

535.43 : 535.542.1 : 535.81 58

Molecular aggregation in optical glasses as reveale by light scattering. KRISHNAN, R. S., AND RAO, P. V *Proc. Indian Acad. Sci. A*, 20, *pp.* 109–116, *Sept* 1944.—Anomalous depolarization was studied b Raman's technique based on the use of the Babin compensator. [Abstr. 1541 (1942)]. Reversal o polarization exists when the incident beam is polarize with vibrations horizontal, and the scattered light elliptically polarized when the incident beam linearly polarized in a direction oblique to th scattering plane. These data support the view tha molecular aggregates exist in glasses. W. R. A

535.542.1 : 535.81 : 535.43 *see Abstr.* 581

535.6 58

Colour tolerance specification. NICKERSON, D AND STULTZ, K. F. *J. Opt. Soc. Amer.*, 34, *pp.* 550 570, *Sept.*, 1944.—Examines a number of formula that have been proposed to express a colour differenc tolerance in terms of the differences of hue, value an chroma. The results obtained by the various for mulae are compared with personal estimates by number of observers. No formula appears to hav outstanding superiority but preference is expresse for the Munsell formula $C/5(2\Delta H) + 6(\Delta V) + 3(\Delta C$ J. W. T. W

535.81 : 535.542.1 : 535.43 *see Abstr.* 581

536.4 : 539.11 *see Abstr.* 639

536.4.031 : 536.421.4 : 551.311.183 *see Abstr.* 724

536.413 : 548.0 58

The thermal expansion of diamond. SAKSENA B. D. *Proc. Indian Acad. Sci. A*, 20, *pp.* 92–99 *Aug.*, 1944.—Grüneisen's law of thermal expansio does not fit Nayar's observations of the change o Raman frequency shift in diamond with temp [Abstr. 113 (1943)]. The expression for therma expansion on the basis of the Raman theory is given and the assumption of a single Grüneisen constant fo diamond is considered unjustifiable. Frequencies ar divided into two groups (high and low) and the volum dependence is assumed to be the same within eac group. By postulating that γ is different for thes groups but the same within each group, it is possibl to fit both the spectroscopic data and thermal expan sion coefficients in the range for which data ar available. W. R. A

536.413 : 548.0 58

Theory of the thermal expansion of the alkal halides. DAYAL, B. *Proc. Indian Acad. Sci. A*, 20 *pp.* 145–154, *Sept.*, 1944.—The Grüneisen formul for the thermal expansion of solids is generalized fo the case when the constant γ is not the same for al

e frequencies of vibration. For NaCl, KCl and Br, the value of γ is different for each frequency hen evaluated on the basis of the Raman theory of ystal vibrations. These new values of γ satis- ctorily correlate experimental data on the cubical oefficient of thermal expansion and on the decrease f the ratio of thermal expansion to specific heat as ie temperature is lowered. W. R. A.

536.413 : 548.0 : 536.63 *see Abstr.* 591

536.421.4 : 536.4.031 : 551.311.183 *see Abstr.* 724

536.423.15 : 536.75 : 535.375.5 : 536.6 *see Abstr.* 589

536.423.4 : 532.62 : 535.43 *see Abstr.* 580

536.423.4 : 532.69 585

Growth of water drops in a Wilson cloud chamber. ARRETT, E. O. *Proc. Amer. Phys. Soc., Berkeley, al., July* 22, 1944. *Abstr. in Phys. Rev.*, 66, *p.* 158, *ept.* 1 *and* 15, 1944.—Water drops formed in a Vilson cloud chamber were photographed with eriodic illumination and their velocity was measured. he drop size was determined by Stokes' law; r^2 aries linearly with time as soon as the drop is large nough to register photographically. A 60 c/s neon ght that moved with const. velocity during the xposure was turned on by the expansion valve. This ight was photographed on the same frame and its lashes were used to establish the zero of the time cale. The straight line obtained from the experi- ental points intersected the time axis 0·1 sec. after he zero; the rate of growth of the drops is smaller luring the first 0·1–0·2 sec. and then reaches a const., alue. The slope of the straight part of the curve vas $7{\cdot}8 \times 10^{-6}$ cm.²/sec.

536.423.4 : 614.7 586

Control of glycol vapour concentration in room air. NIELSEN, C. E. *Proc. Amer. Phys. Soc., Berkeley, Cal., July* 22, 1944. *Abstr. in Phys. Rev.*, 66, *p.* 159, *Sept.* 1 *and* 15, 1944.—When room air is cooled by diabatic expansion, droplets will grow upon nuclei normally present if the temperature falls below the dew point. The addition of glycol vapour should permit condensation with a lesser expansion, glycol in the droplets lowering their v.p. Reduction in the expansion required, water v.p. being maintained const., should thus indicate the v.p. of glycol. Experiments indicate that glycol does reduce the expansion required for condensation, and that the occurrence of condensation can serve to control the rate of addition of glycol to maintain const. glycol v.p.

536.48 : 669 : 539.4/.5 *see Abstr.* 666

536.483 587

Super-fluidity of helium II and attainment of the absolute zero. KAPITZA, P. L. *J. Franklin Inst.*, 237, *pp.* 441–442, *June*, 1944.—A preliminary notice.

536.58 588

Cooling-water temperature control for air compressors. *Engineering*, 158, *p.* 346, *Nov.* 3, 1944.

536.6 : 536.423.15 : 536.75 : 535.375.5 589

The heat capacity and entropy, heats of fusion and vaporization, and the vapour pressure of trimethylamine. The entropy from spectroscopic and molecular data. ASTON, J. G., SAGENKAHN, M. L., SZASZ, G. J., MOESSEN, G. W., AND ZUHR, H. F. *J. Amer. Chem. Soc.*, 66, *pp.* 1171–1177, *July*, 1944.—C_p was measured calorimetrically from 11·83° to 275·90°K for NMe_3 (m.p. 156·08° ± 0·05°K; b.p. 276·03° ± 0·05°K). The v.p. was determined from 190°K to the b.p. and can be represented by $\log_{10}P_{(mm.)} = -2141{\cdot}7743/T - 11{\cdot}400327 \log T + 0{\cdot}0063490017T + 36{\cdot}715267$. The heats of fusion and vaporization (at b.p. and at 250·00°K/250·01 mm.) are: 1 564·0 ± 1·0, 5 482·4 ± 7, and 5 822·6 ± 7 g.cal./mol. Values of vapour density fit the equation $\rho/P = 0{\cdot}000079051P + 0{\cdot}00241364$. The following entropy (S) values are derived from calorimetric data: liquid at m.p. 30·857 ± 0·09; liquid at normal b.p. 47·28 ± 0·14; superheated liquid at 298·16°K 49·82; ideal gas at 200·00°, 250·00°, and b.p. 61·60 ± 0·14, 65·39 ± 0·16, 67·31 ± 0·19 g.cal./deg./mol. An assignment of the Raman spectrum has been made and the values of S from spectroscopic data are: 200°K, 61·60; 250°K, 65·39; b.p. 67·31 g.cal./deg./mol. W. R. A.

536.6 : 541.124 590

Thermodynamic properties of the carbides of chromium. KELLEY, K. K., BOERICKE, F. S., MOORE, G. E., HUFFMAN, E. H., AND BANGERT, W. M. *Tech. Pap. U.S. Bur. Min., No.* 662, 43 *pp.*, 1944.—The preparations of the carbides of Cr are described, and observations of their general properties are recorded. Low-temperature sp. ht. measurements in the range 51° to 298°K are reported for the carbides that are true compounds, Cr_3C_2, Cr_7C_3 and Cr_4C, and for one mixed carbide, "Cr_5C_2." The corresponding entropies are computed. High-temperature heat-content measurements from room temperature up to the limiting temperatures of available containers are reported for Cr_3C_2, Cr_7C_3, Cr_4C and Cr_2O_3. Analytical representations of the results are given. The carbon reduction of solid chromic oxide takes place in 4 distinct, reversible reaction steps, in which Cr_3C_2, Cr_7C_3 and Cr_4C are the intermediate compounds. Results of equilibrium measurements obtained with described apparatus and methods are reported. Each carbide of Cr at temperatures below its m.p. is stable (1) with respect to decomposition into the elements, (2) with respect to decomposition into any lower carbide and carbon, and (3) with respect to decomposition into any higher carbide and Cr: and the intermediate carbide, Cr_7C_3, is stable with respect to decomposition into Cr_3C_2 and Cr_4C.

536.63 : 536.413 : 548.0 591

Lattice spectrum, specific heat, and thermal expansion of lithium and sodium fluorides. DAYAL, B. *Proc. Indian Acad. Sci. A*, 20, *pp.* 138–144, *Sept.*, 1944.—The lattice spectrum, the specific heats, and the coefficients of thermal expansion of LiF and NaF were calculated on the basis of the Raman theory of crystal vibrations. With LiF it is necessary to consider the mutual repulsions of the nearest F′ ions in addition to those existing between neighbouring Na· and F′ ions, and an exponential form of the repulsion potential is assumed. W. R. A.

536.63 : 536.75 592

The heat capacity of carbon tetrachloride from 15° to 300°K. The heats of transition and of fusion. The entropy from thermal measurements compared with the entropy from molecular data. HICKS, J. F. G., HOOLEY, J. G., AND STEPHENSON, C. C. *J. Amer.*

Chem. Soc., 66, *pp.* 1064–1067, *July*, 1944.—C_p values were determined calorimetrically for CCl_4 from 17·09° to 298·49°K. The m.p. is 250·3° ± 0·1°K and there is a transition point at 225·35° ± 0·03°K. Heats of transition and fusion are 1 095 ± 3 and 601 ± 2 g.cal./mol. Values of entropy from calorimetric data are: liquid 51·25 ± 0·15; gas 73·7 ± 0·3 g.cal./deg./mol. at 298·19°K. The values are compared with those derived from mol. data (74·0–74·3 g.cal./deg./mol.). W. R. A.

536.63 : 548.0 593

The specific heats of the alkali halides. DAYAL, B. *Proc. Indian Acad. Sci. A*, 20, *pp.* 77–86, *Aug.*, 1944.—The specific heats of KCl and KBr are evaluated on the basis of the Raman theory of lattice vibrations. The contributions of the optical frequencies ($^{15}/_{16}$th of the total degrees of freedom of the crystal) are calculated, and the remaining $^{1}/_{16}$th are allotted to the elastic spectrum by using a Debye function with a reduced characteristic temperature. Agreement between calculated and observed values obtains throughout the temperature range (KCl, 3°–241°K.; KBr, 78°–234°K.). W. R. A.

536.63 : 548.0 594

The specific heat of metallic silicon. DAYAL, B. *Proc. Indian Acad. Sci. A*, 20, *pp.* 87–91, *Aug.*, 1944.—The specific heats of Si are evaluated on the basis of the Raman theory of crystal vibrations. The 8 discrete frequencies indicated by the theory are calculated from Raman data on Si_2H_6 and the observed compressibility of Si. The residual $^{1}/_{16}$th of the total degrees of freedom of the crystal are allotted to the elastic spectrum and evaluated by a Debye function with a correspondingly reduced parameter deduced theoretically from the force constants. Calculated and observed values agree in the range 20°–1 000°K. W. R. A.

536.633 : 534.22 : 534.321.9 *see Abstr.* 539

536.653 595

The exact calculation of heats of solution from solubility data. WILLIAMSON, A. T. *Trans. Faraday Soc.*, 40, *pp.* 421–436, *Oct.*, 1944.—Schröder's equation, deduced from the van't Hoff isochor applied to solutions, is recalculated by rigorous thermodynamic methods to suit it for non-ideal systems. The fundamental equation found for solutions of electrolytes is

$$\Delta H_{\text{sol.}} = \nu RT^2 \left(\frac{dm}{dT}\right)_{\text{sat.}} \left[\left(\frac{\partial \ln \gamma}{\partial m}\right)_T + \left(\frac{1}{m}\right)_{\text{sat.}}\right]$$

where $\Delta H_{\text{sol.}}$ = heat absorbed per mole of solute dissolved in nearly sat. solution, or heat evolved per mole on crystallization, m = molality, ν = the stoichiometric no. of ions produced per mol of electrolyte, and γ = the mean ionic activity coeff. Non-electrolytes follow a formally similar expression in which $\nu = 1$. When the activity-coeff. term vanishes, the equation reduces to

$$\Delta H_{\text{sol.}} = RT^2(d\ln m/dT)$$

Several examples worked from existing data show satisfactory agreement with calorimetrically measured values. Alternative forms of the fundamental equation, applicable to perfect or imperfect solutions in equilibrium with hydrated or unhydrated solutes of any sort, are developed and tabulated. N. M. B.

536.658 : 539.219.1 : 532.782 *see Abstr.* 522

536.658 : 532.64 *see Abstr.* 514

536.7 596

Transformations of the fundamental equations of thermodynamics. BUCKLEY, F. *J. Res. Nat. Bur. Stand., Wash.*, 33, *pp.* 213–233, *Sept.*, 1944.—A substitution group for generating families of thermodynamic formulae is derived. The method of derivation is based upon the transformation properties of a group of functions under a contact transformation. There exists a characteristic function and a group of functions for each representation, that is, each coordinate system, and to each function of the group there is an associated contact transformation which transforms the group into its equivalent in another representation. The invariance of the functional form of the characteristic groups of functions under contact transformations is equivalent to invariance under a substitution group G* on the space $(EHFG)(V - S - TP)$. The group G* is independent of the representation and can be generated geometrically. There are 4 contact transformations (incl. the identity) associated with each representation. These are equivalent, and from them, families of equations can be found which are invariant under the group G*.

536.7 : 532.713 597

A thermodynamic study of bivalent metal halides in aqueous solution. X. The osmotic and activity coefficients of zinc bromide. STOKES, R. H., STOKES, J. M., AND ROBINSON, R. A. *Trans. Faraday Soc.*, 40, *pp.* 533–537, *Dec.*, 1944.—[See Abstr. 170 (1943)]. The activity coefficient of $ZnBr_2$ was measured at 25° from 0·1 *M* to 17 *M* by isopiestic v.p. measurements. The agreement with similar determinations derived from e.m.f. measurements is not good. The corresponding osmotic-coefficient curve exhibits a break at conc. between 0·7 *M* and 3 *M* which may be due to complex salt formation.

536.7 : 539.152.1 : 531.19 *see Abstr.* 496

536.75 : 535.375.5 : 536.423.15 : 536.6 *see Abstr.* 589

536.75 : 536.63 *see Abstr.* 592

536.77 : 541.138.2 *see Abstr.* 685

536.8 598

Temperature, pressure, and specific-volume changes of a gas mixture under dissociation and re-association conditions, with combustion following the straight-line law, $P = mV + n$. WALKER, W. J. *Phil. Mag.*, 35, *pp.* 680–685, *Oct.*, 1944.—The quantities are computed directly for a mixture of fuel and air and the analysis is extended to obtain the subsequent expansion line. General methods are devised which enable a true indicator diagram to be drawn, use being made of a variable-specific-heat i.c. engine chart. From this diagram the mean effective pressure developed by any fuel may be obtained and also the proportion of re-associated heat discharged to exhaust. L. S. G.

537.12 : 530.145.5 *see Abstr.* 490

537.12 : 539.152.1 *see Abstr.* 645

537.226 : 621.3.011.5 599

An elementary description of some molecular concepts of the structure of dielectrics. MOULLIN, E. B.

. Instn Elect. Engrs, 91, *Part I, pp.* 448–455, *Dec.*, 944.—[Abstr. 296 B (1945)].

537.226 : 621.3.011.5 600

Theory of dielectric constant and energy loss in solids nd liquids. FRÖHLICH, H. *J. Instn Elect. Engrs*, 91, *Part I, pp.* 456–463, *Dec.*, 1944.—[Abstr. 297 B 1945)].

537.226 : 621.315.617.4 601

The dielectric properties of lac. BHATTACHARYA, S. N. *Indian J. Phys.*, 18, *pp.* 1–22, *Feb.*, 1944.—[Abstr. 356 B (1945)].

537.226.8 : 543.812 602

Radio-frequency dielectric properties of a cellulosic ystem at low moisture contents. DUNLAP, W. C., JR., ND MAKOWER, B. *Proc. Amer. Phys. Soc., Berkeley, Cal., July* 22, 1944. *Abstr. in Phys. Rev.*, 66, *p.* 159, *Sept.* 1 *and* 15, 1944.—Measurements were made of he permittivity ε and sp. conductivity σ (a.c. and d.c.) as functions of moisture content (1·5–21·6%) temperature (1·5°–39·8°C.), frequency (18 kc/s–5 Mc/s), density (0·792–1·45 g./cm.^{3}) and particle size (small and medium) of dehydrated carrots. ε increases little with moisture content up to 6–8%; above this region ε increases rapidly. Increase of temperature increases both ε and the rate of change of ε with moisture. At 1·5°C. there is no detectable change of total σ with increase in moisture until 6–8% is reached; above this region the variation becomes exponential. At higher temperatures this apparent discontinuity disappears. Particle size has little effect upon ε or σ, for a given bulk density. Increase of bulk density increases ε and total σ uniformly on a log. scale for all frequencies.

537.228.1 : 553.621 603

A new phenomenon in the piezo-electric oscillations of a quartz crystal. PARTHASARATHY, S., PANDE, A., AND PANCHOLY, M. *J. Sci. Industr. Res.*, 2, *pp.* 1–2, *June*, 1944.—Gives evidence for oscillations of the quartz crystal at 5/2 and 7/2 of the fundamental. Experimental details are described and the results tabulated.

537.228.1 : 553.621 604

Transverse oscillations of a piezo-electric quartz crystal. PARTHASARATHY, S., PANDE, A., AND PANCHOLY, M. *J. Sci. Industr. Res.*, 3, *pp.* 1–2, *July*, 1944.

537.29 : 621.384 : 537.533.7 *see Abstr.* 614

537.312 : 612.79 : 621.317.733 605

Skin-resistance changes and measurement of pain threshold. ANDREWS, H. L. *J. Clin. Invest.*, 22, *pp.* 517–520, *July*, 1943.—[Abstr. 413 B (1945)].

537.312 : 613.286 606

Influence of temperature on changes in storage eggs as measured by radio-frequency conductivity. ROMANOFF, A. L., AND HALL, G. O. *Food Res.*, 9, *pp.* 218–220, *June*, 1944.—It is concluded from experiments here described that the r.f. conductivity of intact hen's eggs increases with their age; this increase is greatly influenced by holding at higher temperatures. The conductivity of eggs at all ages is directly related to the degree of their deterioration. Considering the relative inefficiency of the present primitive method of grading market eggs by candling, further studies of the use of a h.f. field may offer a better method in the evaluation of the quality of table eggs irrespective of their age or the condition of storage. C. J. G.

537.521.6 : 621.3.015.5 607

The apparent breakdown of Meek's streamer criterion in divergent gaps due to the failure of Townsend's ionization function. FISHER, L. H., AND WEISSLER, G. L. *Phys. Rev.*, 66, *pp.* 95–102, *Sept.* 1 *and* 15, 1944.—[See Abstr. 1497 B, 2209 (1940)]. A series of measurements on the dark current i in the same gap showed that it was not represented by $i = i_0 \exp[\int \alpha dx]$ at l.p. The trend and the apparent quantitative variation of K with pressure is explained if the apparent i_0 *v.* voltage curves are extrapolated to streamer onset for each pressure. Thus for practical purposes, under the conditions studied, K is sensibly const. in conformity with Meek's theory. The applications of Meek's theory to gaps with very divergent fields, where the currents can be expected to deviate markedly from those computed by $i = i_0 \exp[\int \alpha dx]$, are not justified, thus placing a practical limitation on the use of Meek's theory to streamer studies. This phenomenon appears when the change of the field exceeds 2% change over an average electron free path.

537.523 : 541.124.7 608

The molecular complexity of some gases in the high-frequency discharge. MCMAHON, H. O., AND MARSHALL, M. J. *Trans. Electrochem. Soc.*, 84, *pp.* 109–120, 1943.—An equation is developed which gives the degree of dissociation of a gas, under the influence of the h.f. discharge, as a function of the temperature gradient of the fractional pressure increase caused by passage of the discharge, corrected for the effect of the increase of thermal conductivity of the gas with temperature. H showed less than 0·5% dissociation. A H-A mixture containing 46·8% H showed a dissociation of 2·6% of the H present, a similar mixture containing 9·2% H showed a dissociation of 76%. N_2 and O_2, present as impurities in A to the extent of 1·8%, were practically completely dissociated, leading to the conclusion that the dissociation of a polyatomic gas mixed with A increases with decrease in its conc. in the mixture. The instantaneous pressure increase was due to heating of the gas.

537.528 : 621.3.015.5 609

Breakdown and time-lag of dielectric materials. Breakdown of liquid carbon tetrachloride. ATTWOOD, S. S., AND BIXBY, W. H. *J. Franklin Inst.*, 235, *pp.* 259–272, *March*, 1943.—[Abstr. 302 B (1945)].

537.531 : 535.215.1 ; 537.533.8 *see Abstr.* 620

537.531 : 535.312 : 548.0 610

A new derivation of the Darwin–Prins formula of X-ray reflection. RAMACHANDRAN, G. N. *Proc. Indian Acad. Sci. A*, 20, *pp.* 100–106, *Aug.*, 1944.—By obtaining a solution of the difference equations which occur in the problem for a crystal containing a finite number (n) of laminations, the case of a crystal of infinite depth can be investigated by proceeding to the limit when $n \to \infty$. The formulae obtained agree with those of Prins for an absorbing crystal. For a non-absorbing crystal the width of the region of perfect reflection is in agreement with

Darwin's value, although there is a difference in the formulae for the variation of intensity with angle outside this region. [See Abstr. 1397 (1943)].

W. R. A.

537.531 : 535.338 : 537.533.8 *see Abstr.* 621, 622

537.531 : 535.339 611

X-ray monochromatization by four balanced filters. KIRKPATRICK, P., AND CHANG, C. K. *Proc. Amer. Phys. Soc., Berkeley, Cal., July* 22, 1944. *Abstr. in Phys. Rev.*, 66, *p.* 159, *Sept.* 1 *and* 15, 1944.—From an X-ray source, adjacent beams, defined by similar diaphragms, are allowed to pass to a common ion chamber. An ion current observation is made with 2 superposed *A* filters in one beam and 2 superposed *B* filters in the other. One *A* and one *B* filter are then transposed and a second current reading is taken. The difference between these currents is a summation to which each wavelength contributes an amount proportional to $(a - b)^2$.

537.531 : 535.345.6 612

Theory and use of Ross filters. II. KIRKPATRICK, P. *Rev. Sci. Instrum.*, 15, *pp.* 223–229, *Sept.*, 1944.—A development of the theory and the construction and application of Ross X-ray filters, formerly described [Abstr. 3345 (1939)]. Filters of a thickness greater than that giving max. pass-band (p.b.) transmission confer some advantages, especially (1) larger ratio of p.b. power to total transmitted power, (2) a larger ratio of p.b. power to error power due to filter unbalance. Auxiliary filters normally rendering balance errors less harmful have, however, no advantages when used with thick balanced filters. Balance errors may be eliminated at more than one wavelength by the use of stepped thickness filters, or at 2 wavelengths by perforation or opaque areas such as diaphragms of differing apertures in front of the filters. Construction is of sheets rolled or ground to the desired thickness, multiple electroplating upon aluminium foil, evaporation of metals on to foil, of aq. solutions in glass cells or powdered absorbent material bonded together with wax. For the last, a special technique is described. Methods of checking the balance of filters with a spectrometer, with fluorescent specimens, by X-radiation not higher in frequency than the l.f. side of the p.b., and by a standard balanced pair, are given. E. D. H.

537.531.8 : 535.215 : 539.261 = 4 613

On the photographic action of secondary electrons resulting from the action of X-rays on metals. TRILLAT, J. J. *C.R. Acad. Sci., Paris*, 216, 4, *pp.* 179–181, 1943.—The photo-electric effect produced by means of X-rays may be used as the basis for microradiography by reflection, in which the sensitive film is only affected by the secondary electrons emitted by the object irradiated. It is necessary to know the law of variation of the photographic density as a function of the atomic number of the element irradiated. A method is outlined for obtaining this by experiment and the law is given in graphical form. L. S. G.

537.533.7 : 537.29 : 621.384 614

The spirotron. DODD, L. E. *Proc. Amer. Phys. Soc., Berkeley, Cal., July* 22, 1944. *Abstr. in Phys. Rev.*, 66, *p.* 160, *Sept.* 1 *and* 15, 1944.—[Abstr. 475 B (1945)].

537.533.72 : 621.385.833 615

On electron microspectroscopy. MARTON, L. *Proc. Amer. Phys. Soc., Berkeley, Cal., July* 22, 1944. *Abstr. in Phys. Rev.*, 66, *p.* 159, *Sept.* 1 *and* 15, 1944.—[Abstr. 487 B (1945)].

537.533.72 : 621.385.833 616

Microanalysis by means of electrons. HILLIER, J., AND BAKER, R. F. *J. Appl. Phys.*, 15, *pp.* 663–675, *Sept.*, 1944.—[Abstr. 489 B (1945)].

537.533.72 : 621.385.833 617

Rigorous calculation of an electrostatic immersion lens. HUTTER, R. G. E. *Proc. Amer. Phys. Soc., Berkeley, Cal., July* 22, 1944. *Abstr. in Phys. Rev.*, 66, *p.* 161, *Sept.* 1 *and* 15, 1944.—The axial potential distribution of this lens is found to approximate that of the electrostatic lens consisting of 2 cylinders of unequal radii which are connected to two potentials $V_1 = \phi_0 e^{-\kappa\pi/2}$ and $V_2 = \phi_0 e^{+\kappa\pi/2}$. The general solution of the paraxial ray differential equation is derived. Based on this solution and the fact that Newton's image equations are satisfied, exact expressions are derived for all important optical quantities (focal lengths, four cardinal points, magnification, object-image relation, and spherical and chromatic aberration). The optimum positions of an object are determined so that the chromatic and spherical aberrations are reduced to a min.

537.533.72 = 4 618

Electron multipliers with magnetic focusing. CHARLES, D. *C.R. Acad. Sci., Paris*, 216, 16, *pp.* 556–558, 1943.—The multiplier consists of 4 semi-infinite planes *A*, *B*, *C*, *D*, such that *A* and *B* lie in a plane $\bar{\omega}$ separated by a gap of width $2d$, and *C* and *D* (also separated by a gap of width $2d$) lie in a plane parallel to $\bar{\omega}$. A Schwarz transformation is used to find the equipotentials (these are drawn) and some examples of electron trajectories are given. An expression is given for the radius of curvature at each point and the condition is found that the paths remain fixed when the field is varied. L. S. G.

537.533.8 : 535.23 619

Momentum and energy of photon and electron in the Čerenkov radiation. COX, R. T. *Phys. Rev.*, 66, *pp.* 106–107, *Sept.* 1 *and* 15, 1944.—The conservation of momentum and energy between an emitted photon and an electron in the Čerenkov radiation [Abstr. 2832 (1943)] gives an equation for the direction of emission. This equation differs from the one which Frank and Tamm derived from electromagnetic theory only by a negligible term involving the ratio of the wavelength of the electron to that of the photon [see Abstr. 1626 (1940)].

537.533.8 : 537.531 : 535.215.1 620

Direct and fluorescence excitation of the L_{III} level in thick targets of thorium. BURBANK, B. G. *Proc. Amer. Phys. Soc., Berkeley, Cal., July* 22, 1944. *Abstr. in Phys. Rev.*, 66, *p.* 160, *Sept.* 1 *and* 15, 1944.—The ratio, *P*, of the probability of exciting the L_{III} shell of Th by direct electron bombardment to the probability of exciting the same shell by photo-electric ionization in a thick target was determined by observation of normally emergent X-rays from an oil-cooled Th-target X-ray tube. The intensities at the peak of the $L\alpha_1$ line and in the continuous back-

ground on each side were measured with a Bragg spectrometer. The target was then covered with a Pd foil thick enough to stop all bombarding electrons, and these intensities were again measured. The $L\alpha_1$ line from the covered target could be produced only by the photo-electric ionization process, while the $L\alpha_1$ line from the bare target could be produced partly by each process. P was calculated for 40 to 100 kV, and was found to decrease from 3·1 at 40 kV to 1·98 at 100 kV.

537.533.8 : 537.531 : 535.338 621

Efficiency of production of continuous X-radiation. KIRKPATRICK, P. *Phys. Rev.*, 66, *pp.* 156–157, *Sept.* 1 *and* 15, 1944.

537.533.8 : 537.531 : 535.338 622

The mean depth of production of continuous X-rays in thick targets of thorium. BURBANK, B. G. *Proc. Amer. Phys. Soc., Berkeley, Cal., July* 22, 1944. *Abstr. in Phys. Rev.*, 66, *pp.* 161–162, *Sept.* 1 *and* 15, 1944.—A thick target of Th was bombarded by 40–100 kV electrons incident obliquely in a direction making a grazing angle of 30° with the target surface. The intensities of several selected wavelengths of the continuous spectrum propagated in a direction at rt. angles to the direction of bombardment were observed with a Bragg spectrometer for a variety of orientations of the target with respect to an axis of rotation coinciding with the electron beam. The mean depths of production were deduced from the slope of a plot of the log. of the intensity v. the sec of the angle of rotation of the target. The average value of the mean depth of production within the spectral range between the h.f. limit and the L_{III} absorption limit increases from $6{\cdot}0 \times 10^{-5}$ cm. at 40 kV to $22{\cdot}2 \times 10^{-5}$ cm. at 100 kV.

537.534.74 : 539.185 : 539.152.1 *see Abstr.* 646

537.591.1 623

Mass determination of the ionizing particles recorded in photographic plates exposed to cosmic rays. CHOUDHURI, B. *Indian J. Phys.*, 18, *pp.* 57–70, *Feb.*, 1944.—Exposure of photographic plates to cosmic radiation at various altitudes (7 000 to 14 500 ft.) results in the formation of tracks due to the primary penetrating particles, probably protons. Some of the tracks were curved, owing to multiple scattering in the nuclear fields of different atomic particles in the emulsion. A statistical method was used to determine the mass of the particles. The average mass depends on the nature of the absorbent under which the plates were exposed. The assumptions used, and the limitations of the method, are discussed. The average mass of particles producing single tracks at 12 000 ft. is approx. that of the mesotron, and is equal to 216 m_0. The energy of the particles is about 10^6 eV. The average mass of particles penetrating 20 cm. H_2O, and paraffin, and 75 cm. wood and mud, was 340–514 m_0, indicating the presence of a fairly large number of proton tracks. This may be due to the presence of fast primary penetrating particles, such as neutrons and protons, which, in traversing hydrogen-containing substances, produce recoil protons of energy approx. 10^6 eV. Exposure of plates under 0·5 to 5 cm. of Pb showed that the average mass of the particles increased to a max. under 1·5 cm. Pb, and then decreased to 1·5 times the mesotron mass under 5 cm. Pb. This is due to the fact that the soft component of the primary radiation undergoes multiplication in traversing Pb, and the secondary emission causes the production of heavy ionizing particles either in the Pb or in the emulsion of the plate.

A. J. M.

537.591.1 624

Proton primaries of atom-annihilation cosmic rays. WARREN, D. T. *Phys. Rev.*, 66, *p.* 156, *Sept.* 1 *and* 15, 1944.—[See Abstr. 2202 (1943)].

537.591.1 : 539.16.08 625

A new method of determining the fraction of electrons in cosmic radiation. BROWN, R. R. *Proc. Amer. Phys. Soc., Berkeley, Cal., July* 22, 1944. *Abstr. in Phys. Rev.*, 66, *p.* 161, *Sept.* 1 *and* 15, 1944.—A cloud chamber containing 7 Pb plates, 3 of 0·2 cm. thickness and 4 of 0·7 cm. thickness, was operated by a 3-counter telescope above the chamber. The counters were made of thin glass and the usual Cu cylinder was replaced by a layer of graphite paint. Above the counters and the chamber was a thin metal roof. The equivalent stopping power of the thin metal roof, the walls of the counters, and the wall of the cloud chamber, was ~10 eMV. The electrons and mesotrons that entered the chamber were differentiated by their shower effects, penetration, and ionization.

537.591.15 626

Cascade showers in lead. HAZEN, W. E. *Proc. Amer. Phys. Soc., Berkeley, Cal., July* 22, 1944. *Abstr. in Phys. Rev.*, 66, *p.* 158, *Sept.* 1 *and* 15, 1944.—In photographs of a cloud chamber that contained 8 lead plates, 50 complete cascade showers were observed. The number of particles at the shower max. v. total number of particles in the shower was plotted. Theory predicts a straight line with slope 0·2. All but one of the experimental points lie above this straight line. The observed showers contain only $^1/_2$ the predicted total number of particles for a given size of shower max. Since a large number of the electrons have energies as low as 3 eMV, it is possible that scattering and increase in ionization for $E < 1{\cdot}5$ eMV would account for the discrepancy. [See Abstr. 627 (1945)].

537.591.15 627

Cascade showers in lead. HAZEN, W. E. *Phys. Rev.*, 66, *pp.* 254–256, *Nov.* 1 *and* 15, 1944.—Showers of energies up to 500–1 000 eMV were photographed in a cloud chamber with 8 Pb plates. A comparison with theory is made in terms of the size of a shower at its max. as a function of the total number of particles in the shower. The theoretical cross-sections for radiation and pair production are correct for energies up to 500–1 000 eMV. [See Abstr. 1368 (1944), 626 (1945)].

537.591.5 628

Variation of mesotron intensity with altitude and latitude, together with allied phenomena, and the bearing of these matters on the nature of the primary particles. SWANN, W. F. G. *J. Franklin Inst.*, 236, *pp.* 1–7, *July, and pp.* 111–139, *Aug.*, 1943.—The vertical mesotron intensity at a given depth below a region of production in which there is a definite energy distribution of mesotrons is calculated. The formula for spectral distribution at sea level in terms

of the spectral distribution at the production level is obtained. These results are extended to the case where there is an assigned rate of production of mesotrons at all altitudes. The formula for spectral distribution is used to test the hypothesis that mesotrons are produced by the disintegration of heavy primary particles. For this purpose it is assumed that the mesotrons have a spectral distribution defined by an energy function proportional to the cube of the energy. This would follow if the true primary particles had an inverse-cube spectral distribution, and if the mesotrons were produced from them at rest in the system of axes in which the primary particle was moving. Within the limits of accuracy of the experimental data, the primary particle is a proton, at any rate for mesotrons produced at moderate altitudes. Theoretical and experimental values are compared for the spectral distribution at sea level and magn. lat. 50°. The angular distribution of electrons emitted by mesotrons at death is discussed, and expressions are derived for the horizontal and vertical electron intensities resulting from death of vertically directed mesotrons. To obtain a sufficiently low mesotron velocity to allow for the large horizontal intensity of electron emission at mesotron death at high altitudes, it is necessary to assume that the primary particles are heavier than protons, and are probably singly charged He atoms. A. J. M.

537.591.5 629

Directional measurements of cosmic radiation. ALFVÉN, H., AND MALMFORS, K. G. *Ark. Mat. Astr. Fys.*, 29*A*, 3, *No.* 24, 16 *pp.*, 1943.—The variation with local solar time of cosmic-ray intensity is investigated by means of coincidence counters directed at altitudes of 30° and 60° to the N. and to the S. alternately, changing at hourly intervals. The total number of counts is $1{\cdot}2 \times 10^8$, spread over 600 days. The hourly values are corrected for barometric variations and collected in 20-day groups. The diurnal variation is represented for the various directions by a vector showing the amplitude and time of the max. The marked difference found betw. the N. and S. vectors shows that periodical atmospheric changes are not the only cause of the diurnal variation. Changes in the Earth's magnetic field or the directional influence of that of the Sun are probably responsible. A. HU.

537.591.8 630

The average specific ionization of cosmic-ray mesotrons in hydrogen. SKOBEL'TSYN, D. V. *Proc. Amer. Phys. Soc., Berkeley, Cal., July* 22, 1944. *Abstr. in Phys. Rev.*, 66, *pp.* 158–159, *Sept.* 1 *and* 15, 1944.—Counter-controlled cloud-chamber photographs of cosmic-ray mesotron tracks in H_2 were taken. The chamber was operated in such a way that the average specific ionization could be obtained from the number of drops that condensed on pos. ions. A triple-coincidence counter telescope was employed, with 2 counters below the cloud chamber and 1 above. Sufficient Pb was placed above and below the top counter so that electron tracks could be distinguished from mesotron tracks. The average specific ionization, excl. energy transfers $>$ 800 eV (clusters of more than 32 drops), is $10{\cdot}5$ ion pairs per cm. of H_2 at N.T.P.

537.742 : 621.317.32 631

Linearity of d.c. vacuum-tube voltmeters. CHAPMAN, S. *Proc. Amer. Phys. Soc., Berkeley, Cal., July* 22, 1944. *Abstr. in Phys. Rev.*, 66, *pp.* 159–160, *Sept.* 1 *and* 15, 1944.—[Abstr. 396 B (1945)].

538.214 : 541.57 632

The hydrogen bond and diamagnetism. ANANTAKRISHNAN, S. V., AND VARADACHARI, P. S. *Proc. Indian Acad. Sci. A*, 20, *pp.* 128–137, *Sept.*, 1944.—Assuming that the CH_2 group contributes a constant amount to molecular diamagnetism, it is shown that H-bonding leads to increased diamagnetism, the susceptibility change being one unit per mol whenever structures of the type O—H . . . O=A are involved. A bifurcated H-bond, as in HIO_3, appears to give a larger value. In alcohols and H_2O, which show a decrease in diamagnetism with association, it would appear that the paramagnetic term associated with distortion is increased. W. R. A.

538.54 = 4 633

On the Foucault currents in an ellipsoid of revolution. JOUGUET, M. *C.R. Acad. Sci., Paris*, 216, 15, *pp.* 523–524, 1943.—The conducting ellipsoid is placed in a uniform alternating field parallel to the axis. Expressions are found for the field both inside and outside the ellipsoid. These involve a series of Legendre polynomials and their derivatives. When the frequency is small and the conductivity is low, the magnetic field inside the ellipsoid is uniform and a formula is found for its intensity. When the frequency is high and the conductivity large, the magnetic field is zero and an expression is given for the density of the surface current. L. S. G.

538.56 : 535.42 : 621.396.616 634

Theory of diffraction by small holes. BETHE, H. A. *Phys. Rev.*, 66, *pp.* 163–182, *Oct.* 1 *and* 15, 1944.—[Abstr. 524 B (1945)].

538.566 : 621.392.1 635

Electromagnetic waves in metal tubes filled longitudinally with two dielectrics. PINCHERLE, L. *Phys. Rev.*, 66, *pp.* 118–130, *Sept.* 1 *and* 15, 1944.—[Abstr. 500 B (1945)].

538.6 : 523.746 *see Abstr.* 462

538.612 636

Some measurements of magnetic double refraction. SNELLMAN, O. *Inaug. Diss., Univ. Uppsala*, 76 *pp.*, 1944.—The electromagnet employed at Uppsala is described (it weighs 37 tons compared with the 120 ton magnet of the French Academy of Science) and the field is measured (by the induction method) for different types of pole shoes. Fields up to 70 000 oersteds may be obtained. The optical arrangement for the measurement of magnetic double refraction is described and the Cotton–Mouton constants of some calibration liquids (nitrobenzene, benzene, toluene, chlorobenzene and acetone) in a refined state are measured. A new value for nitrobenzene is given but the values for benzene and toluene agree with previous determinations. Some anomalies at purification are observed. The variation of the Cotton–Mouton const. with wavelength in the visible region is investigated. The double refraction in some hydrotropic solutions is measured and from these it is clear that association takes place between

the hydrotropic salt and the soluble substance. The double refraction in some dye-stuff solutions (aniline blue, alizarin, sodium sulphonate, pinachrome, alizarin cyanin, azoblue, chrysophenine and anthracene blue) is also measured. A theory is given of the variation of double refraction with wavelength. In this the double refraction is connected with the material constants and the shape of the particle. L. S. G.

538.615 : 530.145.63 *see Abstr.* 493

538.65 : 532.59 637

On the existence of electromagnetic-hydrodynamic waves. ALFVÉN, H. *Ark. Mat. Astr. Fys.*, 29*B*, 2, *No.* 2, 7 *pp.*, 1943.—The application of a magnetic field to a conducting liquid in mechanical motion gives rise to currents which interact with the field so as to change the state of motion. A combined electromagnetic and hydrodynamic wave is set up in which the energy oscillates betw. kinetic and electromagnetic. The motion of a plane wave of this type is studied: its velocity is independent of frequency and of amplitude. The magnetic lines of force may be considered as oscillating with the same velocity as the liquid. An application to the mechanical motions and magnetic fields of sunspots is pointed out. A. HU.

538.7 : 527(09) 638

Some early contributions to the history of geomagnetism. VII. HARRADON, H. D. *Terr. Magn. Atmos. Elect.*, 49, *pp.* 185–186, *Sept.*, 1944.—[See Abstr. 924 (1944)].

539.11 : 536.4 639

Contributions to the theory of co-operative phenomena. TEMPERLEY, H. N. V. *Proc. Camb. Phil. Soc.*, 40, *pp.* 239–250, *Oct.*, 1944.—The word co-operative is used to describe all phenomena such as melting, the occurrence of ferromagnetism or the ordering of a lattice structure, in which finite changes in some of the physical properties of an assembly take place at a definite critical (or Curie) temperature. Ising's theory of the linear lattice with nearest-neighbour interaction [Abstr. 1497 (1925)] is generalized and the main result, that such interaction cannot lead to co-operative effects, is shown to hold for many types of lattice in 3 dimensions. Reasons are given for presuming that a similar result holds for the second nearest-neighbour model, but it is found that even a small interaction of the long-range type can lead to co-operative effects at high temperatures, provided that the nearest-neighbour interaction is sufficiently strong. The critical interaction is discussed and, in this connection, the recent work of Eisenschitz on the specific-heat curve [Abstr. 1025 (1944)] is considered. L. S. G.

539.133 : 535.338.42 640

The energies of polyatomic molecules. NIELSEN, H. H. *J. Opt. Soc. Amer.*, 34, *pp.* 521–528, *Sept.*, 1944. —Vibration-rotation term values of a polyatomic molecule can be obtained to a good approximation by solving for the roots of the secular determinant of a given matrix. The anharmonic corrections to vibration energies entering into the elements of the matrix are not infrequently at variance with experimental data. This divergence is due to certain vibration frequencies of the molecule becoming accidentally degenerate, possibly resulting in resonance. The effects of this, and other types of resonance, are considered. Coriolis types of interaction may result in discrepancy between theory and experiment. This interaction is clearly shown in absorption bands of allene, studied by Thompson. A. J. M.

539.133 : 541.6 641

Electron mobility in large molecules. DENBIGH, K. G. *Nature, Lond.*, 154, *pp.* 642–643, *Nov.* 18, 1944.

539.133 : 548.55 *see Abstr.* 708

539.152.1 642

On the binding energy of deuteron and the neutron-proton scattering by a new potential. WANG, M. H. *Phys. Rev.*, 66, *pp.* 103–106, *Sept.* 1 *and* 15, 1944.—The equation leading to the binding energy is solved in 2 ways by using new forms for the nuclear potential [Abstr. 643 (1944)]. The scattering cross-section of a proton by a fast neutron is also calculated. The results agree well with experiment, when "zero cut-off" of the potential is used. L. S. G.

539.152.1 643

An attempt at finding the relationship between the nuclear force and the gravitational force. WANG, K. C., AND TSAO, H. L. *Phys. Rev.*, 66, *p.* 155, *Sept.* 1 *and* 15, 1944.—It is proposed that the force between 2 nuclear particles may be related to the gravitational force. 2 alternative forms are taken for the potential: I. $V = -Ae^{k/r}$ and II. $V = -(B/r)e^{k/r}$ where $k = h/mc = 3{\cdot}84 \times 10^{-11}$ cm., and A and B are constants determined by the gravitational constant. L. S. G.

539.152.1 644

Further remarks on the difficulties of the meson theory. IWANENKO, D. *Phys. Rev.*, 66, *p.* 157, *Sept.* 1 *and* 15, 1944.

539.152.1 : 536.7 : 531.19 *see Abstr.* 496

539.152.1 : 537.12 645

A self-consistent method of determining the mass of the mesotron. KAR, K. C., AND ROY, R. R. *Indian J. Phys.*, 17, *pp.* 316–320, *Dec.*, 1943.—The wave equation for the deuteron is solved by a self-consistent method (use is made of the δ-function and of Bessel functions) and this leads to a new method for finding the mass of the mesotron. The accuracy of the value obtained (110 e.u.) depends on the accurate value of the binding energy of the deuteron which is known. A Yukawa interaction potential is taken and the mass found agrees with an earlier calculation based on the theory of proton-proton scattering [Abstr. 404 (1943)]. L. S. G.

539.152.1 : 539.185 : 537.534.74 646

The theory of neutron-proton scattering. KAR, K. C., and ROY, R. R. *Indian J. Phys.*, 17, *pp.* 321–325, *Dec.*, 1943.—A wave-statistical theory is developed using an interaction potential of Yukawa type, $V = -Ae^{-\alpha r}/r$. The wave equations of the incident neutron inside and outside the potential field of the proton are written down and the first-order scattering function and the critical approach are calculated. These lead to a formula for the intensity of the scattering and this is found to agree with experiment [Abstr. 404 (1943)] when $A^{1/3} = 6e$ and $\alpha \doteq 0{\cdot}2848 \times 10^{13}$. This value of α gives 110 e.u. as the mass of the mesotron taking part in the

exchange in neutron-proton interaction. This mass is the same as that obtained from the binding energy of the deuteron and from proton-proton scattering.

L. S. G.

539.16.08 647

Experiments on and theory of the action of the Geiger point counter. MORGAN, J., AND BOHN, J. L. *J. Franklin Inst.*, 237, *pp.* 371–384, *May*, 1944.—Smooth darning-needles were found to give the most satisfactory results in a point counter. Characteristic curves for a counter with flat, cylindrical brass caps and a brass cylinder are given. A theory for the action of the counter is given, involving the following assumptions: the existence of an insulating or high-resistance layer of gas at the point, the emission of electrons from the point by positive-ion bombardment, and auto-electronic emission from the point. The lag phenomenon, the dependence of counter action on ionizing rays, on gas and on cathode material, the existence of 3 characteristic curves, and cold-cathode emission, can be satisfactorily explained on the above assumptions. A. J. M.

539.16.08 648

The measurement of absolute efficiencies of gamma-ray counters. PEACOCK, W. *Proc. Amer. Phys. Soc., Berkeley, Cal., July* 22, 1944. *Abstr. in Phys. Rev.*, 66, *p.* 160, *Sept.* 1 *and* 15, 1944.—By the use of the isotopes Na^{24}, Co^{60}, Mn^{54}, I^{131}, Y^{86}, Fe^{59}, Mn^{56} and Co^{58}, the absolute efficiency of screen-wall Cu, Pt and Bi counters was determined. With the isotopes Br^{82}, Au^{198}, I^{130}, Mn^{52}, Na^{22} and V^{48}, the efficiency curves thus determined were confirmed. The efficiency curves agree with theory (Droste). With several isotopes, each emitting a single monochromatic γ-ray, it is possible to compare the efficiency of γ-ray detecting instruments at various energies.

539.16.08 649

Geiger counters. CRAGGS, J. D. *Metrop.-Vick. Gaz.*, 20, *pp.* 342–348, *Oct.*, 1944.—An illustrated description of the construction and operation.

539.16.08 : 537.591.1 *see Abstr.* 625

539.16.08 : 621.317.722 650

Traumatic shock. III. A modified electroscope especially suited for measuring substances with low-energy radiation. SELIGMAN, A. M. *J. Clin. Invest.*, 22, *pp.* 281–284, *March*, 1943.—[Abstr. 412 B (1945)].

539.164.2 651

On the theory of emission of alpha-particles from radioactive nuclei. DUBE, G. P., AND JHA, S. N. *Indian J. Phys.*, 17, *pp.* 344–356, *Dec.*, 1943.—The rectangular potential hole of the Condon–Gurney–Gamow model is replaced by an exponential potential function $V = -V_0 e^{-r/r_0}$ and an expression is worked out for the decay constant λ. The exact form and magnitude of the potential function inside the nucleus plays a very insignificant rôle in the problem. In the two cases V_0 very small and V_0 very large, the decay constants λ_0 and λ_∞ are both independent of V_0 and ratio λ_∞/λ_0 is of the order 5. The nuclear radius r_0 is calculated using the experimental data for the decay constant λ and the energy E and all the radii except those of ThC, RaC are found to lie between $7{\cdot}8$ and $9{\cdot}7 \times 10^{-13}$ cm.

539.185 : 537.534.74 : 539.152.1 *see Abstr.* 646

539.185.9 : 591.484 652

The action of neutrons on the developing rat retina. SPEAR, F. G., AND TANSLEY, K. *Brit. J. Radiol.*, 17, *pp.* 374–379, *Dec.*, 1944.

539.217.3 : 621.317.39 653

Application of a thermal conductivity method to the determination of moisture-vapour transmission of packaging materials. BOOR, L., AND DIXON, J. K. *Paper Tr. J.*, 119, *TAPPI Sect.*, *pp.* 176–184, *Nov.* 2, 1944.—[Abstr. 405 B (1945)].

539.217.5 : 552.517.4 654

Fluid flow through porous media. III. Air permeability of consolidated sands partly saturated with water. SEN GUPTA, N. C. *Indian J. Phys.*, 17, *pp.* 338–343, *Dec.*, 1943.—Apparatus for measuring gas permeabilities of consolidated sands, partly saturated with liquids, is described. The max. rates of flow of air beyond which the observed permeabilities tend to diminish were found for 7 samples of dry consolidated oilwell sands from Assam oil fields. Air permeabilities of these core samples at different degrees of water saturation were obtained, keeping the rate of flow within the above limit. When the relative air permeabilities were plotted against the corresponding water saturations the curves obtained with the different core samples could be divided into two types. In the first type, the air permeability was constant within the limits of experimental error until the liquid saturation exceeded a certain value (5–15%) beyond which the permeability diminished, and became zero as the liquid saturation approached 100%. With the second type, the permeability began to diminish as the liquid saturation increased from zero. [See Abstr. 2862 (1943)].

539.219.1 : 536.658 : 532.782 *see Abstr.* 522

539.26 655

On the optimum thickness of powder specimens in X-ray diffraction work. TAYLOR, A. *Phil. Mag.*, 35, *pp.* 632–638, *Sept.*, 1944.—The optimum thickness of a flat specimen is found both for transmission and reflection spectra. For a cylindrical specimen exact mathematical treatment is difficult but the absorption factor is found using the method of Claassen [Abstr. 2214 (1930)] and Bradley [Abstr. 3753 (1935)]. This leads to the optimum thickness, when it exists.

L. S. G.

539.261 : 535.215 : 537.531.8 = 4 *see Abstr.* 613

539.31 : 548.0 *see Abstr.* 705

539.31 = 4 656

On a particular solution of the equations of elasticity. PARODI, H. *C.R. Acad. Sci., Paris*, 216, 4, *pp.* 172–173, 1943.—A solution (u_1, u_2, u_3) may be written in the form

$u_i = (l_{i_1}x + l_{i_2}y + l_{i_3}z)f(\alpha x + \beta y + \gamma z)$, $(i = 1, 2, 3)$

where α, β, γ and the elements of the matrix $||l_{ij}||$ are constants satisfying certain linear conditions, and f is an arbitrary function. Expressions for the tensions are given. L. S. G.

539.32 : 679.5 657

Effect of environmental conditions on mechanical properties of organic plastics. CARDSWELL, T. S., AND NASON, H. K. *Mod. Plast.*, 21, *pp.* 121–126 *et seq.*, *June*, 1944, *and pp.* 125–130 *et seq.*, *July*, 1944.—Young's modulus, yield strength, ultimate strength

nd impact strength are examined in relation to emperature, continuous heat, moisture, chemical gents and weathering. Numerous charts illustrate ne effects. E. R. A.

39.32 : 679.5 658

Stiffness and brittleness of non-rigid vinyl-chloride–cetate-resin compounds. CLASH, R. F., JR., AND TERG, B. M. *Mod. Plast.*, 21, *pp.* 119–124 *and* 160, *uly*, 1944.—Methods of evaluating the change of echanical properties over a temperature range – 80°C. to + 40°C. are studied, selecting standard ests for cantilever and torsion stiffness, and brittle-ess of non-rigid plastics. Charts illustrate results f these tests. E. R. A.

39.383 : 678 659

Stiffening effect of pigments in rubber. GEHMAN, . D. *Industr. Engng Chem.*, 36, *pp.* 715–719, *Aug.*, 944.—The relative effect of volume loading of arbon blacks on stiffness in compression is calculated. greement with experimental curves is good. The heory explains the systematic change in shape of oad compression curves as pigment loading is in-reased. It accounts qualitatively for the divergence etween the dynamic and static modulus for stocks vith carbon-black loadings.

39.389.3 : 539.4.016 : 678 660

Effect of milling on properties of Hevea and Buna ubbers. WIEGAND, W. B., AND BRAENDLE, H. A. *ndustr. Engng Chem.*, 36, *pp.* 699–702, *Aug.*, 1944.—he superior cut-growth resistance of Hevea tread tocks over similar GR-S tread compounds is ascribed n part to the relaxation and lengthening of the natural roduct when subjected to severe dynamic flexure, s contrasted with the failure of GR-S to relax and engthen. GR-S is further handicapped by its original hortness. Means other than the use of softeners ave been sought to overcome these shortcomings. he behaviour of Hevea and some of the synthetic olymers was studied under prolonged and repeated illing. A method of processing GR-S which engthens it with resultant improvement in resistance o cut growth and heat embrittlement is described.

539.389.3 : 539.4.016 : 678 661

Time/temperature relations in oven ageing of GR-S. HARRISON, S. R., AND COLE, O. D. *Industr. Engng Chem.*, 36, *pp.* 702–707, *Aug.*, 1944.—Results of laboratory stress/strain and dynamic cut-growth tests show that the time/temperature relations for a definite change in properties follow a general form: $\log t = kT + C$ where t = time of ageing, T = temperature of ageing, k and C are constants. The temp. coeff. for changes in stress/strain properties brought about by oven ageing were: 1·972 (200%), 2·00 (300%), 1·945 (tensile strength), and 1·957 (elongation at break) for every 10 deg. C. rise in temperature. The temp. coeff. for change in rate of cut growth was 1·715 for every 10 deg. C. This lower value is attributed to the effect of hysteresis and/or relaxation during the test. After ageing, the properties of overcured samples were superior to those of optimum cured samples.

539.389.3 : 539.4.016 : 678 662

Vulcanization and heat ageing of GR-S. MASSIE, G. M., AND WARNER, A. E. *Industr. Engng Chem.*, 36, *pp.* 720–724, *Aug.*, 1944.—A mixture of GR-S and EPC black, in the absence of curatives, stiffens when subjected to heat. Tests were made on a GR-S tread compound. Persistent accelerators contribute to an increasing stiffness with corresponding decrease in elongation, and loss in tear resistance with increasing time of cure and on air-oven ageing. A non-persistent accelerator and the addition of diphenyl ethylene diamine aid in reducing these effects. In a GR-S vulcanizate containing a non-persistent accelerator, the amount of added S has a marked effect on the rate of change in physical properties on air-oven ageing; 5 parts of ZnO yield a more stable vulcanizate than lesser amounts; natural rubber antioxidants show varying degrees of effectiveness in maintaining elongation after air-oven ageing.

539.389.3 : 539.4.019 : 678 663

Ageing of GR-S vulcanizates in air, oxygen and nitrogen. SHELTON, J. R., AND WINN, H. *Industr. Engng Chem.*, 36, *pp.* 728–730, *Aug.*, 1944.—Comparison of the ageing of GR-S type vulcanizates in a highly purified N_2 atmosphere with the results obtained in both the oxygen bomb and air oven shows that O_2 plays an important part in the changes. The tensile strength is virtually unchanged in N_2. The modulus increase obtained in the oxygen bomb at 80°C. is independent of O_2 in the ageing atmosphere. At 100°C., more than half of the hardening, as measured by the modulus increase after 5 days in air, may be attributed to the action of the O_2.

539.389.3 : 678 664

Effect of moisture on curing rate of GR-S. BRAENDLE, H. A., AND WIEGAND, W. B. *Industr. Engng Chem.*, 36, *pp.* 724–727, *Aug.*, 1944.—Moisture content of the raw polymer correlates with its curing rate. Excessively dry (slow-curing) polymers can be accelerated by moisture addition. Soap and other water-soluble impurities do not appear to be the cause of curing-rate fluctuations. The changes in total moisture content of a GR-S tread compound incident to changes in the moisture content of the carbon black do not affect cure. Conditioning of mixed stocks to increase their moisture content accelerates cure; at 0·5 to 1·0% moisture on a tread compound, curing rate is reasonably well stabilized even among polymers from different plants and with differing soap contents. An alternative method of cure stabilization is suggested.

539.4 : 678 665

Acrylonitrile-butadiene copolymers. EMMETT, R. A. *Industr. Engng Chem.*, 36, *pp.* 730–734, *Aug.*, 1944.—Mixtures of Hycar OR with Geon 102 were prepared covering the range of concentrations of polyvinyl chloride from 0 to 100%. These combine, in varying degrees, the sunlight, ozone, and aromatic-solvent resistance of polyvinyl chloride with the oil-resistant and thermosetting properties of Hycar OR. A favourable combination of properties was found with 75% Hycar OR-15 and 25% Geon 102. Comparative compounding data are given on Hycar OR-15 and a blend of 75 parts Hycar OR-15, 25 parts Geon 102, and 25 parts tricresyl phosphate in typical compounds. The mixture has improved resistance to tearing, flex cracking, and ageing as compared with Hycar OR-15.

539.4.01 : 676.4 *see Abstr.* 748

539.4.01 : 677.46 *see Abstr.* 749

539.4.016 : 678 : 539.389.3 *see Abstr.* 660–662

539.4.019 : 678 : 539.389.3 *see Abstr.* 663

539.4/.5 : 536.48 : 669 666

Properties of metals and alloys at sub-zero temperatures. DONALDSON, J. W. *Metal Treatm., pp.* 161–170, *Autumn*, 1944.—Reviews important researches carried out during 1939–44 and quotes results. A list of references is included. M.-V.

539.414 : 534.013 *see Abstr.* 528

539.5 : 621.983.3 667

Effect of shape on the formability of deep-drawn sheet-metal parts. BOX, W. A., AND SCHROEDER, W. *Mech. Engng, N.Y.*, 66, *pp.* 643–648 *and* 662, *Oct.*, 1944.—[Abstr. 577 B (1945)].

539.501 : 679.5 = 3 668

On the rheometry of organic glasses. I. SCHEELE, W., ALFEIS, M., AND LAHAYE, L. *Kolloidzschr.*, 103, *pp.* 1–7, *April*, 1943.—The change in mechanical properties of thermoplastics, caused by the addition of plasticizers, by changes in the degree of polymerization and by variations in the temperature, is investigated by rheological measurements. The 4 different types of flow curves, pure viscous, pure plastic, quasi-viscous and quasi-plastic flow, are discussed. Flow curves for 4 different polyvinyl-acetates at different temperatures are given. The area between the flow curve, the velocity axis and a parallel to the shearing-stress axis is termed the "deformation power" and is shown to depend on temperature in a way similar to viscosity according to the Andrade–Sheppard relation. This permits a more general evaluation of flow curves. R. N.

539.56 : 678 669

Effect of elastomer crystallization on tests for freeze resistance. FORMAN, D. B. *Industr. Engng Chem.*, 36, *pp.* 738–741, *Aug.*, 1944.—During long exposures to moderately low temperatures, Neoprene (GN) and rubber show a delayed stiffening that begins after 24 to 28 hr. This is caused by crystallization of the elastomer. The degree of crystallization is a function of the state of cure. The magnitudes of the increases in hardness are dependent upon the filler and softener content of the elastomer. Neoprene (FR and GR-S) do not show crystallization effects. Compounds of Neoprene (FR) containing certain softeners may undergo delayed stiffening. Some Neoprene (GN) compounds show the same effect. The effects of plasticizers are summarized.

54 : 679.5 *see Abstr.* 759

541.123.2 670

The binary system of P_2O_5-2CaO . P_2O_5. I–II. HILL, W. L., FAUST, G. T., AND REYNOLDS, D. S. *Amer. J. Sci.*, 242, *pp.* 459–477, *Sept., and pp.* 542–562, *Oct.*, 1944.—Equilibrium relations between P_2O_5 and 2CaO . P_2O_5 were studied by the method of quenching. The data are recorded and the results given in phase diagrams. Eight crystalline phases are stable at liquidus temperatures: tetragonal (?) P_2O_{5n} with a triple point at 580° and 55·5 cm., CaO . $2P_2O_5$, m.p. 810°, $2CaO . 3P_2O_5$, m.p. 774° (incongruent), CaO . P_2O_5, m.p. 977° (metastable), α-calcium metaphosphate, m.p. 984°, trömelite (observed as a series of solid solutions from 32 to 37% CaO), which is metastable below 915° and melts incongruently at 985°, $2CaO . P_2O_5$ and α-calcium pyrophosphate, m.p. 1 353°. The $\alpha \rightleftharpoons \beta$ inversion points of CaO . P_2O_5 and $2CaO . P_2O_5$ lie at 693° and 1 140°, respectively. Solid solutions were noted only in the metaphosphate-pyrophosphate system, where they occur on an extensive scale, the ranges for the β-modifications being the greater.

541.123.3 : 669.7 671

The constitution of aluminium-copper-magnesium alloys at 460°C. LITTLE, A. T., HUME-ROTHERY, W., AND RAYNOR, G. V. *J. Inst. Met.*, 70, *pp.* 491–506, *Oct.*, 1944.—The equilibrium diagram of the system Al-Cu-Mg was investigated for alloys annealed to equilibrium at 460°C. The range of alloys examined was sufficiently great to include the compositions of all the solid phases with which the Al-rich or α-solid solution is in equilibrium. At 460°C. the phase boundary is divided into 4 sections, corresponding to equilibrium with the $CuAl_2$, *S*, *T*, and liquid phases, respectively. The α-solid-solubility curve was determined accurately at 460° and 375°C., and the triangles representing the $(\alpha + CuAl_2 + S)$ and $(\alpha + S + T)$ 3-phase fields were established at 460°C. The composition of the *S* phase corresponds with the simple formula Al_2CuMg, in contradiction to the results of previous investigators. The $\alpha/\alpha + S$ phase boundary is shown to obey an equation of the type $[Mg] \times [Cu] = K$, where [Mg] and [Cu] are the atomic percentages of Mg and Cu, respectively. The *T* phase is isomorphous with the phase based on the composition $Al_2Mg_3Zn_3$ and its composition is in the neighbourhood of that given by Laves and Witte, namely, Al_6CuMg_4.

541.124 672

Reaction between solids. CASTELL, H. C., DILNOT, S., AND WARRINGTON, M. *Nature, Lond.*, 153, *pp.* 653–654, *May* 27, 1944.—An investigation of the formation of spinel, $MgAl_2O_4$, from MgO and α-Al_2O_3 above 1 000° shows that, in accordance with theory, spinel is formed at a higher rate in a reducing atmosphere or in vacuum than in air. One set of briquettes, containing 5% of added Mg powder, was heated in vacuum, and the other was heated without evacuation of the furnace. Debye diagrams, made from the products, compared with those of spinel and the original reaction mixture, showed ~65% spinel in the vacuum-baked product and ~20% in the air-baked one. N. M. B.

541.124 673

A comparative study of the kinetics and mechanisms of formation of the phenylhydrazone, semicarbazone, and oxime of *d*-carvone. STEMPEL, G. H., JR., AND SCHAFFEL, G. S. *J. Amer. Chem. Soc.*, 66, *pp.* 1158–1161, *July*, 1944.—The reactions between NH_2OH, phenylhydrazine, and semicarbazide and *d*-carvone proceed by the same mechanism, are acid-catalysed, show no salt effect, and have velocities ∝ to the conc. of the ketone and the carbonyl reagent. Data agree with Hammett's mechanism for the semicarbazide reaction. W. R. A.

541.124 : 536.6 *see Abstr.* 590

541.124.7 : 537.523 *see Abstr.* 608

541.127 674

Velocity and yield in continuous-reaction systems. DENBIGH, K. G. *Trans. Faraday Soc.*, 40, *pp.* 352–

43, *Sept.*, 1944.—A mathematical paper investigating the yield and kinetics of a reaction carried out continuously (with flow through a number of tanks, stirring in each, and discrete changes of conc. at each link) as distinct from batchwise (reactants flowing in uniform motion through a single vessel with a min. of mixing). Equations are set up relating the size of reaction space and rate of production; the relative efficiencies of working of the two types of reaction and the attainment of optimum conditions are discussed. N. M. B.

541.127 675

The influence of alkyl groups upon reaction velocities in solution. V. The formation of phenyltrialkylammonium iodides in methyl alcohol. EVANS, D. P. *Chem. Soc., pp.* 422–425, *Sept.*, 1944.—A study of the reactions between several dialkylanilines and methyl iodide shows that in passing from methyl- to dialkylanilines to diethyl-, ethylpropyl-, dipropyl-, or dibutyl-aniline, there is a large increase in activation energy accompanied by a rise in the factor *PZ* of the kinetic equation. The observations are interpreted as being due to a steric effect of the terminal methyl groups coupled with the possible formation of a C–H bond.

541.128 676

The action of chromia catalyst on aliphatic *iso*-alcohols and *iso*-aldehydes. KOMAREWSKY, V. I., AND SMITH, L. G. *J. Amer. Chem. Soc.*, 66, *pp.* 1116–1117, *July*, 1944.—At atm. pressure in the presence of Cr_2O_3, *iso*-$C_5H_{11}OH$ forms Bu^{β}_2CO by a condensation-dehydrogenation (*c–d*) process. *Iso*-alcohols, having an α-substituted C, give no (*c–d*) reactions but are dehydrogenated to the corresponding aldehydes which remain unaffected by relatively high pressures. *Iso*-amylaldehyde at higher pressure is converted to 2 : 6-dimethylheptene-3 and at atm. pressure to Bu^{β}_2CO in presence of Cr_2O_3. These results support the aldol mechanism. W. R. A.

541.128 677

Catalytic aromatization of branched-chain aliphatic hydrocarbons. KOMAREWSKY, V. I., AND SHAND, W. C. *J. Amer. Chem. Soc.*, 66, *pp.* 1118–1119, *July*, 1944.—Aliphatic hydrocarbons, containing a quaternary C, which does not permit direct aromatization, are dehydrocyclized in presence of Cr_2O_3-Al_2O_3 catalysts to aromatic hydrocarbons indicating that isomerization occurs during dehydrocyclization. Dehydrocyclization of aliphatic hydrocarbons, having a structure which allows cyclization in more than one way, takes place by a mechanism permitting their direct formation. W. R. A.

541.128 : 535.375.5 *see Abstr.* 574

541.128.1 : 541.138.3 *see Abstr.* 689, 690

541.128.2 678

On the kinetics of nitric acid. ABEL, E. *Trans. Faraday Soc.*, 40, *pp.* 544–545, *Dec.*, 1944.—[See Abstr. 1418 (1944)].

541.132 : 535.375.5 679

Study of electrolytic dissociation in strong electrolytes by Raman effect. RAO, N. R. *Indian J. Phys.*, 17, *pp.* 332–337 *and* 357–364, *Dec.*, 1943.—The Raman spectrum of trichloracetic acid exhibits conspicuous changes on dilution of the acid. On comparing the spectra of the acid at different concentrations and of Li and Na salts of this acid, the lines of this acid are attributed to different kinds of radicals, $(CCl_3COOH)_2$, CCl_3COOH and CCl_3COO. This assignment is further supported by the corresponding changes that these lines undergo on increasing the temperature and *p*H by adding HCl to this acid. Also, on comparing this acid with acetic acid, the lines are attributed to different bonds, C—C, C—O, C=O, etc. Phosphoric acid and phosphates, bicarbonates and perchloric acid are dealt with. Raman spectra of solutions of H_3PO_4 are similar to that of H_2SO_4 and the lines attributed to various kinds of radicals. The dissociation of H_3PO_4 is rapid as far as the removal of the first H ion is concerned, while further dissociation is very slow.

541.133.08 : 532.14 680

Electrical conductance of aqueous solutions. I. Sodium and potassium bromates at 25°, and the conductance of the bromate ion. JONES, J. H. *J. Amer. Chem. Soc.*, 66, *pp.* 1115–1116, *July*, 1944.—Values of conductivity were measured at 25° for aq. $KBrO_3$ (0·0005–0·15 *M*) and aq. $NaBrO_3$ (0·0005–0·5 *M*) and densities of aq. $NaBrO_3$ (0·0005–0·3 *M*) were determined at 25°. The conductivity BrO'_3 at 25° is 55·78 ± 0·05. W. R. A.

541.135.1 681

The electrolysis of the nitroparaffins. PEARSON, R., AND EVANS, W. V. *Trans. Electrochem. Soc.*, 84, *pp.* 173–178, 1943.—The lower aliphatic nitro-compounds are good ionizing solvents capable of being electrolysed if a base is added to cause ionization. The cathodic product is the *N*-alkyl hydroxylamine. The anodic product is the carbonyl compound corresponding to the nitroparaffin and NO_2. Low current yields are due to the oxidation of the *N*-alkyl-hydroxylamine at the anode.

541.135.3 : 621.357.13 682

The electrochemistry of baths of fused aluminium halides. III–IV. WEHRMANN, R., YNTEMA, L. F., AND VERDIECK, R. G. *J. Phys. Chem.*, 48, *pp.* 259–279, *Sept.*, 1944.—[Abstr. 452 B (1945)].

541.138 683

Oxidation-reduction potentials: their significance and applications. STONEHILL, H. I. *J. Soc. Dy. Col., Bradford*, 60, *pp.* 176–183, *July*, 1944.—A descriptive survey covering mechanism, reaction systems, determination of standard redox potentials, with tabulated standard reversible values, applications to analysis, potentiometric redox titration, and redox indicators. N. M. B.

541.138.2 684

The electrolytic oxidation of thiosulphate in ethylene glycol solution. GLASSTONE, S., BARR, V. V., AND HESTON, B. O. *Trans. Electrochem. Soc.*, 84, *pp.* 179–186, 1943.—In properly buffered glycol solutions, thiosulphate can be electrolytically oxidized to tetrathionate at a smooth Pt anode with almost 100% efficiency. The presence of small amounts of water has little influence on the efficiency, although there is a slight falling-off as the proportion of water is increased. Catalysts for H_2O_2 decomposition (Mn^{++} and Cu^{++}), which reduce the oxidation efficiency in aq. solution, have little effect in glycol.

In the presence of Mn^{++}, traces of water do not affect the formation of tetrathionate, but with increasing quantities, the efficiency falls off in a linear manner with the amount of water present. The anodic formation of tetrathionate in glycol solution is unaffected by alteration of *p*H in the range of 5 to 9, provided hydroxyl ions are absent. The mechanism of the anodic oxidation of thiosulphate to tetrathionate is different in glycol and in water.

541.138.2 : 536.77 685

Reduction of nitroguanidine. XII. Oxidation potentials of the nitro-nitrosoguanidine and the nitroso-aminoguanidine systems. HAHN, C., PRIBYL, E., LIEBER, E., CALDWELL, B. P., AND SMITH, G. B. L. *J. Amer. Chem. Soc.*, 66, *pp.* 1223–1226, *July*, 1944.—The normal oxidation potentials of the nitro-nitrosoguanidine and of the nitroso-aminoguanidine system were determined. Mechanisms, in terms of probable ionic forms of the reactant, for these reduction reactions have been suggested which are based on E_H/pH functional relationships. The free energies and the equilibrium constants of the reactions involved are calculated from the normal oxidation potentials of the several oxidation systems.

541.138.3 686

Electrolytic reduction of cinnamic acid. A new preparative method for βγ-diphenyladipic acid. WILSON, C. L., AND WILSON, K. B. *Trans. Electrochem. Soc.*, 84, *pp.* 153–163, 1943.—The reduction of cinnamic acid at a Hg cathode in aq. H_2SO_4 containing dissolved organic solvent to increase solubility of the organic acid is described. The product contained less than 10% of β-phenylpropionic acid, the rest consisting of approx. equal amounts of βγ-diphenyladipic acid and polymeric material which was differentiated from the adipic acid by its high solubility in cold benzene. The material seems to be formed by the union of 2 or more cinnamic acid molecules with reduction of some of the carboxyl groups. A 55% yield of diphenyladipic acid, containing approx. equal amounts of the 2 stereoisomers, was obtained. Some substituted cinnamic acids have also been reduced and adipic acids have been obtained.

541.138.3 687

The electrolytic reduction of amides. I. *N,N*-dimethylvaleramide and acetanilide. SWANN, S., JR. *Trans. Electrochem. Soc.*, 84, *pp.* 165–172, 1943.—The electrolytic reductions of *N,N*-dimethylvaleramide to *N,N*-dimethylamylamine and of acetanilide to ethylaniline in H_2SO_4 solutions were studied at cathodes of Cd, Sn, Pb, Hg, Zn, Al, Bi, Cu, Ni, Fe and Co. The best yields were obtained at a Pb cathode. Cd and Zn showed some activity. The best yield of ethylaniline was obtained at a Pb cathode. The only other active cathode was Cd. The influence of the physical condition of the surface of the cathode is discussed.

541.138.3 688

The polarographic reduction of rhodium compounds. WILLIS, J. B. *J. Amer. Chem. Soc.*, 66, *pp.* 1067–1069, *July*, 1944.—Rh complexes formed between $RhCl_3$ and KCN, KCNS, $KCl + C_5H_5N$, and chloropentammine rhodic chloride are stable towards Hg and give well-defined polarographic steps. Each reduction takes place from Rh^{III} to Rh^{II} and in no case was the reduction Rh^{III} to Rh. Some Rh complexes show no polarographic steps. W. R. A.

541.138.3 : 541.128.1 689

Electrolytic reduction of trinitro aromatic compounds to triamines by use of a carrier catalyst. LEWIS, R. W., AND BROWN, O. W. *Trans. Electrochem. Soc.*, 84, *pp.* 135–143, 1943.—A $SnCl_2$ carrier catalyst was employed in the electrolytic reduction of: 2,4,6-trinitrobenzoic acid to 2,4,6-triaminobenzoic acid; 2,4,6-trinitrotoluene to 2,4,6-triaminotoluene; and 2,4,6-trinitrophenol to 2,4,6-triaminophenol. A study of the conditions affecting the reduction was made.

541.138.3 : 541.128.1 690

The electrolytic reduction of *p*-nitrobenzoic acid to *p*-aminobenzoic acid. RAVENSCROFT, P. H., LEWIS, R. W., AND BROWN, O. W. *Trans. Electrochem. Soc.*, 84, *pp.* 145–151, 1943.—*p*-nitrobenzoic acid is reduced electrolytically to *p*-aminobenzoic acid in yields of 98 to 98·5% using a Sn cathode and a $SnCl_2$ carrier catalyst. The reduction is also carried out at a Pb cathode to give yields of the amine amounting to 94 to 95%. A method for isolating the pure amino acid is described.

541.144 : 535.371 691

Some observations on the photochemistry of fluorescent substances. I. The quenching of fluorescence by nitric oxide and the photochemical formation of nitroxides. II. Concentration quenching (self-quenching) of fluorescence. WEIL-MALHERBE, H., AND WEISS, J. *J. Chem. Soc.*, *pp.* 541–547, *Oct.*, 1944.—The quenching of the fluorescence of polycyclic hydrocarbons in solution by NO is described and discussed. In character and extent it is analogous to the effect of O. An attempt was made to isolate stable products of the photochemical reaction between hydrocarbons and NO, but owing to the instability of the primary photo-nitroxides, only a few mg. of nitrogenous products were obtained in crystalline form. The concentration quenching of polycyclic hydrocarbons and of ethylchlorophyllide was investigated in various solvents in an atmosphere of pure N_2 and in the absence of foreign quenching substances. The primary photochemical process of self-quenching is represented by an interaction between excited and normal molecules, and the hyperbolic quenching equation was valid in all cases. The relation between self-quenching and the photochemical formation of dimers is discussed. In photo-sensitized oxidations with ethylchlorophyllide, self-quenching effects are of great importance, as the lifetime of the excited chlorophyll molecule is largely dependent on the concentration quenching even in the presence of other quenching substances.

541.147 : 771.53 692

A proposed spectral sensitivity index to describe photographic emulsions. WHITE, D. R. *J. Franklin Inst.*, 237, *pp.* 289–299, *April*, 1944.—The use of filter factor data for specifying colour sensitivity of photographic emulsions is advocated. A specific method of test is outlined, and a form for presentation of results is proposed. Indication is given of the calculations which can be made from the data. Good agreement is obtained between calculated and experimental values. The proposed spectral sensitivity

ex is of sufficient breadth and precision to be a ctical indication of this emulsion characteristic.
A. H.

.147.7 : 771.54 693
Symposium on microsensitometry and micrositometry. *Photogr. J.*, 84, *pp.* 287–295, *Oct.*, 4.—Introduction, Harrison, G. B. The astronical aspect, Hunter, A. [Abstr. 456 (1945)]; crodensitometry in X-ray crystallography, Stokes, R. [Abstr. 712 (1945)]; Microdensitometry in ntitative spectrographic analysis, Smith, D. M., Liddiard, E. A. G. [Abstr. 704 (1945)].

.18.04 : 631.4 694
A rapid method for the mechanical analysis of soils extensive soil survey work. VYAS, N. D., AND RA, K. C. *Curr. Sci.*, 13, *pp.* 225–227, *Sept.*, 4.

.182.02 : 531.73 : 532.13 695
The size and shape of tobacco mosaic virus particles. UFFER, M. A. *J. Amer. Chem. Soc.*, 66, *pp.* 1188–4, *July*, 1944.—Two essentially monodisperse parations of tobacco mosaic virus had intrinsic cosities of 39·0, sedimentation constants corrected water at 20° of 185 Svedberg units, and one had diffusion const. corrected to water at 20° of 3×10^{-8} cm.^{2}/sec. The partial sp. vol. was ermined on 2 chemically purified preparations to 0·73. The size and shape of the predominating ticles were calculated from various combinations the above constants. A partially aggregated paration of virus had a bimodal distribution of rticle sizes, as determined from an electron microph, and an intrinsic viscosity of 80·7, and 2 undaries in the ultracentrifuge with sedimentation nstants of 187 and 216*s*. A highly aggregated virus paration had a very high sedimentation rate and rinsic viscosity.

.182.043 : 532.133 696
The influence of concentration upon the sedimentation e of tobacco mosaic virus. LAUFFER, M. A. *Amer. Chem. Soc.*, 66, *pp.* 1195–1201, *July*, 1944.—e reciprocal of the sedimentation const. is a ear function of virus conc. When the sedimentation e is corrected for the viscosity of the virus solution tead of for that of the solvent, this dependence on conc. largely vanishes. There remains a small idual effect in the oppposite direction which may interpreted as being due to non-ideality of the ution. Data from the literature on the sedimentan of various polymers and macromolecules show t this close relationship between the apparent c. dependence of sedimentation rate and solution cosity is fairly general.

.182.4 697
The permanence of an emulsion sponsored by a Mona x. AHERNE, J. C., AND REILLY, J. *Trans. Faraday c.*, 40, *pp.* 551–555, *Dec.*, 1944.—An emulsion of ter in liquid paraffin, promoted by a Mona wax, is own by size-frequency technique (when precautions e taken against submission of the system to undue turbance) to possess good permanence. Since the tem has low mechanical stability [see Abstr. 2296 44)], it is concluded that permanence and stability e not interdependent characteristics of emulsions.

541.183 698
Adsorption of riboflavin by lactose. Influence of temperature. LEVITON, A. *Industr. Engng Chem.*, 36, *pp.* 744–747, *Aug.*, 1944.

541.183.2 699
The adsorption of paraffin-chain salts to proteins. I. Some factors influencing the formation and separation of complexes between gelatin and dodecyl sodium sulphate. PANKHURST, K. G. A., AND SMITH, R. C. M. *Trans. Faraday Soc.*, 40, *pp.* 565–571, *Dec.*, 1944.—The adsorption of dodecyl sodium sulphate to gelatin in aq. solutions and the influence of electrolyte concentration, *p*H and temperature, on the separation of adsorption complexes was studied. Evidence is adduced that adsorption is continuous until a unimolecular layer of DSS ions attached by their polar groups to the basic N atoms of the protein is formed. Further addition of DSS results in the formation of a reverse layer with polar groups outermost, and eventually peptization occurs.

541.23 : 531.754 *see Abstr.* 504

541.24 : 532.77 *see Abstr.* 521

541.486 : 535.323 = 3 *see Abstr.* 560

541.5 : 541.6 700
The constitutive changes of the covalent linkages, their nature and cause. BURAWOY, A. *Trans. Faraday Soc.*, 40, *pp.* 537–544, *Dec.*, 1944.—Deformation effects contribute considerably to the physical properties of H_2 and other covalent linkages. The constitutive changes of covalent linkages within polyatomic molecules are analysed and their nature is discussed. The introduction of the hypothesis of resonance among several (idealized) valence bond structures is unnecessary and in disagreement with numerous facts. Atoms in a different valency state behave like different atoms and, consequently, are responsible for quantitative, but not qualitative, changes of linkages. [See Abstr. 2304 (1944)].

541.57 : 538.214 *see Abstr.* 632

541.6 : 539.133 *see Abstr.* 641

541.6 : 541.5 *see Abstr.* 700

541.65 : 535.375.51 *see Abstr.* 577

541.651 : 535.342 *see Abstr.* 570

541.68 : 532.14 : 532.133 *see Abstr.* 511

541.68 : 678 701
Structural features of Buna S. Relation to physical properties. KEMP, A. R., AND STRAITIFF, W. G. *Industr. Engng Chem.*, 36, *pp.* 707–715, *Aug.*, 1944.—The non-symmetry in the chain structure is discussed in relation to the prevention of crystallization and the impeding of cross-linking during vulcanization. Fractionation data on a regular benzene-soluble crude Buna S indicates the presence of an objectionable broad range of polymer sizes. The lowest-mol. polymer fractions are not chemically bound in the vulcanizate but remain soluble in chloroform. By removing most of this low polymer, the chloroform extract of the vulcanizate decreases accordingly. Vulcanizates were prepared from high- and low-mol. fractions of Buna S. The high fractions were tough, dry, and difficult to handle on the mill; the low fractions were soft and sticky. The tensile strength of vulcanizates from the high fraction was > that of the whole polymer, but the modulus was

considerably increased. For the low-mol.wt polymer, both tensile and modulus values were lower. Vulcanizates prepared by mixing natural rubber and gutta-percha hydrocarbons show lower strength than either of the hydrocarbons separately tested.

543.812 : 537.226.8 *see Abstr.* 602

545.371 : 616.314 *see Abstr.* 743

545.371 : 620.193.2 702

Galvanic corrosiveness of soil found by simple *p*H test. PHELPS, H. S., AND KAHN, F. *Elect. World, N.Y.*, 122, *pp.* 93–96, *Aug.* 19, 1944.—[Abstr. 263 B (1945)].

545.82 : 669.71 703

Modifications of spectrographic methods for analysis of aluminum and its alloys. CALLON, R. W., AND BURGENER, J. E. *J. Opt. Soc. Amer.*, 34, *pp.* 543–549, *Sept.*, 1944.—Describes the spectrographic methods employed by the Aluminum Co. of Canada. Full details are given of the preparation of the samples and a graphical calculating board is described. To illustrate the methods, the standard procedure for (*a*) the pure metal, (*b*) an alloy, is described. A. H.

545.82 : 771.54 704

Microdensitometry in quantitative spectrographic analysis. SMITH, D. M., AND LIDDIARD, E. A. G. *Photogr. J.*, 84, *pp.* 293–295, *Oct.*, 1944.—A survey article dealing with the application of sensitometry to spectrographic analysis. A. H.

548.0 : 534.1 *see Abstr.* 530

548.0 : 535.312 : 537.531 *see Abstr.* 610

548.0 : 536.413 *see Abstr.* 583, 584

548.0 : 536.413 : 536.63 *see Abstr.* 591

548.0 : 536.63 *see Abstr.* 593, 594

548.0 : 539.31 705

Corrigenda to the paper "On the stability of crystal lattices. IX. Covariant theory of lattice deformations and the stability of some hexagonal lattices." BORN, M. *Proc. Camb. Phil. Soc.*, 40, *pp.* 262–263, *Oct.*, 1944.—Several mistakes and misprints in a previous paper [Abstr. 639 (1942)] are noted and the corrections are given. These do not modify the special results of the paper, but they give the correct general formulae. L. S. G.

548.0 : 620.179.16 706

A new method for determining the elastic constants of crystals. BHAGAVANTAM, S., AND BHIMASENACHAR, J. *Curr. Sci.*, 13, *p.* 229, *Sept.*, 1944.

548.1 : 549.211 707

Normal oscillations of the T_d class diamond structure. BHAGAVANTAM, S. *Proc. Indian Acad. Sci. A*, 20, *pp.* 122–127, *Sept.*, 1944.—Normal oscillations of the T_d class diamond structure were obtained from group theory on the basis of a 16-atom cell as the repeating unit, the same method having been previously applied to the O_h class structure [Abstr. 1878 (1944)]. Besides translation, there are 9 normal oscillations, all degenerate (three 3-fold, two 4-fold, two 6-fold, two 8-fold). Expressions are derived for the corresponding normal frequencies. W. R. A.

548.55 : 539.133 708

Crystal structure of coronene. ROBERTSON, J. M., AND WHITE, J. G. *Nature, Lond.*, 154, *pp.* 605–606, *Nov.* 11, 1944.

548.73 70

The crystal structure of ammonium pentachlorozincate. KLUG, H. P., AND ALEXANDER, L. *J. Amer. Chem. Soc.*, 66, *pp.* 1056–1064, *July*, 1944.—The crystal structure of $(NH_4)_3\,ZnCl_5$, determined from Laue and rotating- and oscillating-crystal photographs by the Patterson–Harker and Bragg–Fourier methods, is orthorhombic bipyramidal, $a_0 = 8{\cdot}74$, $b_0 = 9{\cdot}84$, $c_0 = 12{\cdot}61$ Å, space group D_{2h}^{16}–*Pnma*, four $(NH_4)_3ZnCl_5$ molecules per unit cell. The positions of the atoms are fixed by 16 parameters. Zn atoms are surrounded by Cl atoms at 2·25 Å and one extra Cl not co-ordinated with Zn. These extra Cl atoms are surrounded by NH_4^+ ions at an average distance of 3·41 Å. One kind of NH_4^+ ion is surrounded by a trigonal prism of Cl atoms at an average distance of 3·44 Å, whilst the other NH_4^+ groups are surrounded by an irregular polygon of 8 Cl at an average distance of 3·32 Å. The Zn-Cl linkings in the $ZnCl_4''$ tetrahedra are essentially covalent whilst all other bonds (N–H excepted) are essentially ionic. The structure consists of NH_4^+, $Zn^{\cdot\cdot}$, and Cl' ions and the formula is $(NH_4)_2ZnCl_4 \,.\, NH_4Cl$. W. R. A.

548.73 71

An X-ray examination of crystals of triphenylmethyl chloride and bromide. WANG, S. N., AND LU, C. S. *J. Amer. Chem. Soc.*, 66, *pp.* 1113–1114, *July*, 1944.—From X-ray examination of crystals of Ph_3CCl and Ph_3CBr the hexagonal units of structure have $a_0 = 13{\cdot}97 \pm 0{\cdot}02$ and $13{\cdot}86 \pm 0{\cdot}02$, $c_0 = 13{\cdot}17 \pm 0{\cdot}02$ and $13{\cdot}36 \pm 0{\cdot}03$ Å, six mols per unit cell, space group C_{3i}^1—$H\bar{3}$ or C_3^1—$H3$. The halogen atoms have been approx. located. W. R. A.

548.73 71

Crystal structure of β-aluminium-magnesium alloy. PERLITZ, H. *Nature, Lond.*, 154, *p.* 606, *Nov.* 11, 1944.

548.73 : 771.54 71

Microdensitometry in X-ray crystallography. STOKES, A. R. *Photogr. J.*, 84, *pp.* 290–293, *Oct.* 1944.—A brief account is given of the way in which X-ray diffraction photographs are taken and the uses to which they are put. The photometric side is then described and the possible errors dealt with. A. H.

549.211 : 535.372 *see Abstr.* 571

549.211 : 535.372 : 535.375.51 *see Abstr.* 576

549.211 : 548.1 *see Abstr.* 707

549.211 : 620.179 : 621.9 : 621.386.1 71

X-rays and industrial diamonds. II. TUNNICLIFFE, E. J. *Industr. Diamond Rev.*, 4, *pp.* 271–273, *Dec.* 1944.—[Abstr. 491 B (1945)].

550.34 71

Bibliography of seismology, Jan.–June, 1944. HODGSON, E. A. *Publ. Dom. Obs., Ottawa*, 13, 15, *pp.* 253–267, 1944.—[See Abstr. 398 (1945)].

550.341 : 534.647 *see Abstr.* 542

550.37 : 550.384 : 523.746.5 71

Summary of earth-current records from Tucson, Arizona, for a complete sunspot cycle. ROONEY, W. J. *Terr. Magn. Atmos. Elect.*, 49, *pp.* 147–157, *Sept.* 1944.—The tables give for each component yearly and monthly values of the mean diurnal variation as recorded on all days and on the 10 calmest days

each month. From the yearly values the general relation between earth-current activity and solar ivity, as indicated by sunspot numbers, is apparent. e monthly values confirm a number of features eviously reported. [Abstr. 221 (1941)]. Since e records cover a full sunspot cycle and afford useful terial for further study of the relationship between gnetic variations, earth-currents, and the conditions isting in the ionized layers of the upper atmosphere.

0.372 : 621.396.11 716

Electrical properties of Indian soils at medium oadcast frequencies. RAHMAN, S. F., AND MUHI, F. *dian J. Phys.*, 18, *pp.* 31–37, *Feb.*, 1944.—The ctrical conductivity and the permittivity were termined each for 7 frequencies within the medium oadcast frequency range, and with different moisture ntents, by the differential transformer method. e conductivity increases with both frequency and oisture content, the rate of increase with moisture great while that with frequency is small. The rmittivity decreases with frequency and increases th moisture content. From the observed values of e soil conductivity at 20% moisture, the field-strength enuation curves for all the stations (except Delhi) the All-India Radio are drawn. Suitable aerial ights in relation to wavelengths are calculated for the A.I.R. transmitting stations.

0.381 717

List of geomagnetic observatories and thesaurus of lues. VI. FLEMING, J. A., AND SCOTT, W. E. *rr. Magn. Atmos. Elect.*, 49, *pp.* 199–205, *Sept.*, 44.

0.384 : 523.746 718

Solar and magnetic data, April to June, 1944, ount Wilson Observatory. NICHOLSON, S. B., AND ULDERS, E. S. *Terr. Magn. Atmos. Elect.*, 49, . 209–210, *Sept.*, 1944.

0.384 : 523.746.5 : 550.37 *see Abstr.* 715

0.385 719

Principal magnetic storms, April–June, 1944. *rr. Magn. Atmos. Elect.*, 49, *pp.* 206 *and* 212, *pt.*, 1944.

0.386 : 551.594.52 *see Abstr.* 729

0.389 720

American magnetic character-figure, C_A, three-hour-nge indices, K, and mean K-indices, K_A, for April to ne, 1944. JOHNSTON, H. F. *Terr. Magn. Atmos. lect.*, 49, *pp.* 181–184, *Sept.*, 1944.

0.389 721

Five international quiet and disturbed days for anuary to March, 1944. JOHNSTON, H. F. *Terr. lagn. Atmos. Elect.*, 49, *p.* 209, *Sept.*, 1944.

0.834 : 621.396.99 722

Combination of amplitude and frequency modulation r communication in seismograph exploration for etroleum reservoirs. SHOOK, E. M., OLSON, R. W., ND KERR, R. B. *Proc. Inst. Radio Engrs, N.Y.*, 32, . 583–590, *Oct.*, 1944.—[Abstr. 545 B (1945)].

51.241 : 526.6 723

Modern evidences for differential movement of certain oints on the Earth's surface. STETSON, H. T. *Science*, 00, *pp.* 87–93, *Aug.* 4, *and pp.* 113–117, *Aug.* 11, 944.—Inter-station discrepancies in observations of the variation of latitude may be due to differential displacements of the observatories concerned. The Talcott method of lat. observation presupposes a knowledge of accurate declinations, whilst observation of stars above and below pole, which does not, is complicated by refraction. Differences of longitude can now be determined from radio time signals with a probable error of $\pm 0{\cdot}007$ sec. Variations of many times this amount have been detected in trans-Atlantic comparisons. Some of the long. variation is due to the annual term in the lat. variation, but an unexplained portion remains. Other long. re-determinations of the past 20 yr. reveal discrepancies which could be due to crustal displacements. Caution is urged in assuming that the effective velocity of radio signals is const. Vertical displacements of the Earth's crust found from gravimeter records are discussed and further observations recommended. A. HU.

551.311.183 : 536.4.031 : 536.421.4 724

Regarding the formation of anchor (ground) ice. BENEDICKS, C., AND SEDERHOLM, P. *Ark. Mat. Astr. Fys.*, 29*A*, 3, *No.* 22, 7 *pp.*, 1943.—A semi-logarithmic plot of the sp. vol. of ice and of super-cooled water around 0°C. shows that even at -10°C. the sp. vol. of water is much lower than that of ice. Ground ice, therefore, cannot be formed by the gravitational transport of surface ice crystals to the bottom. Since ice and quartz both crystallize in the hexagonal system in a similar manner, a sandy bottom will facilitate the formation of ground ice. The heat of crystallization will raise the temperature of the adjacent layer of water to 0°C., at which it is relatively heavy: further growth is therefore inhibited, and frazil ice will not form because nuclei will have been removed by the earlier crystallization. A. HU.

551.510.535 : 621.396.9 : 526.92 *see Abstr.* 486

551.515.2 725

Racer's storm (1837), with notes on other Texas hurricanes in the period 1818–1886. GEISER, S. W. *Field and Lab.*, 12, *pp.* 59–67, *June*, 1944.

551.526.6 726

Monthly mean surface temperatures of the sea. SANDSTRÖM, J. W. *Ark. Mat. Astr. Fys.*, 29*A*, 3, *No.* 16, 18 *pp.*, 1943.—Monthly, seasonal and annual means of surface temperatures in $1° \times 1°$ rectangles of the N.E. Atlantic are derived from observations betw. 1900 and 1937. The method of correcting temperatures observed near the boundary of a unit of space or time to the centre of the unit is described. The mean temperatures are plotted on 15 charts on which surface isothermals are indicated. A. HU.

551.577.37 ≈ 3 727

Evaluation of 30-year records of the rainfall stations of the Central Meteorological Institute. KROPF, A. *Schweiz. Bauztg*, 123, *pp.* 225–229, *May* 6, 1944.—Zürich records of intensity r and duration T of rain-storms in the period 1912–1941 are examined. For storms of a given annual frequency, the law $r = CT^{-\alpha}$ is found to hold for $10 < r < 1\,000$ min. For shorter periods of heavy rain the intensity is less than that expected from this relation. Values of C and α are tabulated for different annual frequencies n where $1 > n > 0{\cdot}1$, and the results are compared with other Swiss values and with mean results for Germany.

The author indicates briefly how the results can be applied to the civil-engineering problems involved, especially in the design of drainage systems. A. HU.

551.594.12 = 4 728

Electrical equilibrium of an ionized atmosphere (theoretical distribution with height, of the electric field, the conductivity and the ionization density). CAGNIARD, L. *Ann. Phys., Paris*, 19, *pp.* 71–87, *Jan.–March*, 1944.—A stationary state is supposed to exist in a calm ionized atmosphere free from large ions; 3 differential equations of the 1st order, describing the ionized state, are set up, the general integral depending on 3 arbitrary constants. These are calculated by means of 3 initial conditions imposed by physical considerations. An appropriate change of variable shows that the coefficients appearing in the equations have very different orders of magnitude. The effect of this is that in the lower atmosphere the electrical parameters depend only on the mobility and the rate of production and recombination of ions. An integration of the equations is only necessary at high altitudes. Graphs are given showing the distribution of the electric field, the conductivity and the ionization density over heights up to 26 km. At 11 km. there are discontinuities in the derivatives of these 3 quantities. L. S. G.

551.594.52 : 550.386 729

The geographic incidence of aurora and magnetic disturbance, northern hemisphere. VESTINE, E. H. *Terr. Magn. Atmos. Elect.*, 49, *pp.* 77–102, *June*, 1944.—A statistical analysis is made of auroral data accumulated in the period 1872–1942. The author studies the variation with geographic position of the average daily frequency of aurora in high latitudes, and of geomagnetic disturbance. The effect of cloud and daylight on the observed frequency of aurora is assessed, and corrections are applied to the observations made during the Polar Years, and during other miscellaneous investigations of the past 70 years, to obtain comparable auroral frequencies. The results are exhibited in the form of isochasms and are compared with lines of equal magnetic disturbance.

A. HU.

552.517.4 : 539.217.5 *see Abstr.* 654

553.621 : 537.228.1 *see Abstr.* 603, 604

576.8.095.4 : 518.4 730

Graphical representation of growth gradients. HEWLETT, P. S. *Nature, Lond.*, 154, *pp.* 611–612, *Nov.* 11, 1944.

576.8.097 731

The adaptation of *Bact. lactis aerogenes* to certain changes of medium. LODGE, R. M., AND HINSHELWOOD, C. N. *Trans. Faraday Soc.*, 40, *pp.* 571–579, *Dec.*, 1944.—A strain of *Bact. lactis aerogenes* in an artificial medium shows a rapid and reversible adaptation to a change of its C source from glucose to glycerol or of its N source from $(NH_4)_2SO_4$ to glycine. The particular form of the growth curves and a comparison of the growth of washed and unwashed cells suggest the hypothesis that adaptation is due to a change in the balance of enzymes controlling the lags of competing growth processes.

576.8.097.3 732

Studies in the mechanism of bacterial adaptation. DAVIES, D. S., HINSHELWOOD, C. N., AND PRYCE, J. M. *Trans. Faraday Soc.*, 40, *pp.* 397–419, *Sept.*, 1944.— When *B. lactis aerogenes* (A) is cultured in presen of proflavine, observed data are interpreted postulating that proflavine interferes with the synthes of the essential growth factor normally found in t filtrate, and that adaptation occurs by an expansion the enzyme responsible for its production. T mechanism by which this expansion can occur (in difficultly reversible manner) is considered. T action of methylene blue on (A) generally resembl that of proflavine; adaptation to the dye occu readily. Determination of the lag/age relations sho that (A), immunized by serial subculture in proflavin is also immune to methylene blue; when trained methylene blue it is immune to proflavine. The actio of crystal violet is mainly similar to that of proflavin Cells adapted to resist sulphonamide are not train to proflavine, and immunity to it may be conferre on these cells with partial loss of sulphonamide in munity, but proflavine-trained cells may also acqui immunity to sulphonamide without losing it to pr flavine. A simple working model of two couple enzyme systems explains some of the salient facts bacterial adaptations. The adaptation to proflavi of (A) does not occur during the lag phase, and retarded neither by increased acidity of the mediu nor by the accumulation of the lag-removing diffusib cell product. N. M.

576.8.097.5 : 612.11 73

Outline of a mathematical theory of the removal malarial parasites from the blood stream. LANDAH H. D. *Bull. Math. Biophys.*, 6, *pp.* 93–104, *Sept* 1944.—In the type of disease considered, the infectio is due to parasites which multiply at regular interval This regularity impresses a "periodicity" upon th course of the disease. A set of differential equatio is proposed which describes the kinetics of interactio between such parasites and continuously produce phagocytes. Some general conditions, based on thes equations, are found in order that the number parasites should increase or decrease. Some conse quences of the equations, of biological significanc are discussed and experiments are outlined for th determination of the parameters appearing in th equations. L. S. G

577.16A : 535.243 *see Abstr.* 556

577.16A : 535.372 *see Abstr.* 572

581.44 : 634.97 73

On the form and strength of trees. I. The trunk OPATOWSKI, I. *Bull. Math. Biophys.*, 6, *pp.* 113–118 *Sept.*, 1944.—In a previous paper [Abstr. 2281 (1943)] a theory of form of plants was developed, based o concepts of metabolism and mechanical strength The theory of the strength of materials and know experimental relations between the strength and sp. g of green wood are now used to derive relation between some geometric characteristics of the tree.

L. S. G

591.111 73

On the theory of blood-tissue exchanges. I. Funda mental equations. SMITH, R. E., AND MORALES, M. F *Bull. Math. Biophys.*, 6, *pp.* 125–131, *Sept.*, 1944.— A theoretical analysis of the absorption of an iner gas by a heterogeneous system of n phases, e.g. a limi consisting of n tissues, is presented. The total uptak

of gas up to a given time is given in terms of various biological parameters and the theory predicts how the uptake curve should change in shape under a variety of physiological conditions, and how, from the numerical values of the constants, the values of certain tissue constants (permeabilities) may be obtained.

L. S. G.

591.175.6 736

Adaptation or accommodation in unstriated muscle. SINGH, I. *Proc. Indian Acad. Sci., B*, 19, *pp.* 91–114, *April*, 1944.—There are two kinds of adaptation to a.c. During one, the sensitivity to K decreases, and during the other, it increases. One is probably produced by Ca, and the other by ions outside. There are two kinds of adaptation to chemical stimulation; one is similar to the first kind of adaptation to a.c. and the second one is probably due to diffusion of ions into the muscle fibres. This kind of adaptation also occurs to a.c. Adaptation may be diminished by leakage of the adaptation factor, neutralization of the same or inhibition of adaptation. This last appears to be responsible for tonic withdrawal contractions. Adaptation increases with length. Adaptation and fatigue are identical.

591.175.6 737

The effect of temperature and ions on the impedance of unstriated muscle and its relation to permeability and excitability. SINGH, I., AND SINGH, S. I. *Proc. Indian Acad. Sci. B*, 19, *pp.* 130–146, *April*, 1944.—The resistance of plain muscle is less than that of striated muscle, and the former is more permeable than the latter. H ions increase the resistance of striated and plain muscle; they diminish the permeability of plain muscle and cause inhibition. Cations increase or decrease the resistance of striated muscle in the order $Li < Na < NH_4 < K$. Anions decrease the resistance of plain and striated muscles in the order $Cl < Br < NO_3 < I < SCN$; they increase the permeability of plain muscle in the same order. In skeletal muscle they increase the resistance in the same order if contracture occurs. Ca increases the resistance of plain and striated muscles; in the latter it may have an opposite action. In plain muscle it decreases permeability to ions. Mg increases the resistance of striated muscle; Ba may increase or decrease, while Sr has no significant action. Large conc. of ions greatly decreases the resistance. The resistance of striated and unstriated muscle decreases with temperature; there may be increase at high temp. or before death. At about 0°C., the resistance greatly increases. Compression increases the resistance, owing to squeezing out of fluid from between the fibres; this makes any slight increase in the resistance of muscle during contraction of doubtful significance.

591.175.6 : 591.484.3 738

Similarities between the excitation phenomena in unstriated muscle and those in the retina. SINGH, I. *Curr. Sci.*, 13, *pp.* 152–153. *June*, 1944.—Close resemblances have been observed between excitation phenomena in the retina and in those produced in unstriated muscle under the stimulus of 10 V a.c. at 3, 10 and 12 sec./min. and with 5 V at 10 sec./min. Further possible analogies to be deduced from these data are discussed. C. J. G.

591.484 : 539.185.9 *see Abstr.* 652

591.484.3 : 591.175.6 *see Abstr.* 738

612.015 739

Simplified equations for the distribution of chloride in body water. WILDE, W. S. *Bull. Math. Biophys.*, 6, *pp.* 105–111, *Sept.*, 1944.—The equations describe, in terms of the plasma potassium concentration, the distribution of chloride expected when the quantity of salt in the body fluids changes in health and disease. L. S. G.

612.11 : 576.8.097.5 *see Abstr.* 733

612.79 : 621.317.733 : 537.312 *see Abstr.* 605

612.84 740

A contribution to the mathematical biophysics of visual perception and aesthetics. RASHEVSKY, N., AND BROWN, V. *Bull. Math. Biophys.*, 6, *pp.* 119–124, *Sept.*, 1944.—A continuation of previous studies [Abstr. 1438 (1943)]. An expression for the total intensity of excitation in a discriminating centre as a function of the intensity of the peripheral stimulus is derived, and applied to the case of aesthetic judgment of similar polygons of different sizes. The theoretical conclusions are found to be in agreement with experimental results obtained by the use of standard psychological scaling methods. L. S. G.

612.85 741

The rehabilitation service for the hard of hearing at Deshon General Hospital, Butler, Pennsylvania. TRUEX, E. H., JR. *J. Acoust. Soc. Amer.*, 16, *pp.* 71–74, *July*, 1944.—The hospital was designed to treat at least $^1/_3$ of the many thousands of patients whose hearing will be below standard. In addition to army personnel, there are 19 lip-reading teachers, 1 speech teacher, 1 acoustic physicist and 1 teacher for training in the use of residual hearing. Four otologists are army officers. The chief problem is to fit the patient with the most satisfactory hearing-aid and teach him the art of reading lips. In about 8 weeks the patients are restored to the army or civilian life equipped with the max. available benefits the hospital can supply.

G. E. A.

612.85 : 534.75 *see Abstr.* 543

613.286 : 537.312 *see Abstr.* 606

614.7 : 536.423.4 *see Abstr.* 586

614.71 : 535.21 742

Ray length in sanitary ventilation by bactericidal irradiation of air. WELLS, W. F. *J. Franklin Inst.*, 238, *pp.* 185–194, *Sept.*, 1944.

616.314 : 545.371 743

Need for an instrument to measure *p*H in localized areas of the mouth. THOMAS, B. O. A. *Proc. Inst. Radio Engrs, N.Y.*, 32, *pp.* 453–454, *Aug.*, 1944.—The shallow, narrow gingival crevice around the neck of the tooth contains a fluid, the *p*H of which may or may not agree with that of the saliva. An acid fluid may decalcify the tooth structure with which it is in contact in the cervical region. Since the great majority of lesions occur on the side of the tooth next to the lip or cheek, does the fluid in the gingival crevice vary in *p*H locally in relation to a single tooth? The problem demands a much more sensitive indicator than the litmus papers which are in present use. The instrument must be capable of use directly in the oral cavity, and must require a min. of fluid.

620.179.16 : 548.0 *see Abstr.* 706

629.135 : 531.767 : 533.6.011.4 *see Abstr.* 526

631.4 : 541.18.04 *see Abstr.* 694

634.97 : 581.44 *see Abstr.* 734

658.5 : 662 744

The pattern of fuel research. KING, J. G. *J. Inst. Fuel*, 17, *pp.* 5–14 *and* 25, *Oct.*, 1944.—This 1944 Melchett lecture is a review of (i) the hydrogenation of coal and coal products, (ii) the gasification of coal and (iii) the constitution and properties of coal. Each section is dealt with in a way which shows the importance of conducting researches in accordance with pre-conceived patterns. These patterns naturally differ in different investigations and are followed in detail for (i) and (ii), but no well-defined pattern is evident for (iii). Several lines of further work are indicated. When organizing researches, such patterns should be formulated and care should be taken to insure that the various aspects follow the desired time schedule. Staff and equipment should be allocated on the basis of this schedule. R. W. P.

662 : 658.5 *see Abstr.* 744

669 : 536.48 : 539.4/.5 *see Abstr.* 666

669.7 : 541.123.3 *see Abstr.* 671

669.71 : 545.82 *see Abstr.* 703

676.1.04 : 678.7 *see Abstr.* 751

676.2.02 745

Magnesium bisulphite pulping process. TOMLINSON, G. H. *Pulp Pap. Mag. Can.*, 45, *pp.* 817–820, *Oct.*, 1944.—Flow sheets are given for the complete reuse of the waste liquors obtained from the pulping of wood using $MgH_2(SO_3)_2$ in place of $CaH_2(SO_3)_2$. The liquor is evaporated (this occurs without scale formation) and burned; the MgO and SO_2 are dissolved out of the flue gases and used in further digestions, and the heat of combustion of the organic matter is utilized. Alternatively, the evaporated liquor may be fermented (the alcohol being obtained by distillation), or treated for vanillin recovery. J. G.

676.3 746

Use properties of newsprint. DODGE, W. G. *Pulp Pap. Mag. Can.*, 45, *pp.* 604–609, *July*, 1944.—Factors affecting the printability of newsprint are discussed. Desirable characteristics are smoothness, ink absorbency and optical properties (e.g., opacity and brightness, insofar as they affect show-through and strike-through by the ink). J. G.

676.3 : 774/777 747

Developments in the graphic arts for the year 1943. KANTROWITZ, M. S. *Paper Tr. J.*, 119, *TAPPI Sect.*, *pp.* 92–98, *Sept.* 7, 1944.—A review, with bibliography, covering specialty papers, ink and materials for its manufacture, inking mechanisms, photo-engraving, electrotyping, lithography, stereotype plates, printing plates made of plastics, paint printing, and bookbinding. J. G.

676.4 : 539.4.01 748

Observations on wet-strength paper. BRITT, K. W. *Paper Ind.* 26 *pp.* 37–41, 1944.—The true criterion of the wet strength of a paper after complete saturation is the ratio wet-strength/dry-strength. Groundwood pulp raises the wet strength of a paper containing it, especially after ageing; alkaline-cooked pulps produce lower values than sulphite pulps. Rosin sizing and waxing have no appreciable effect, but tub-sizing and coating produce slight increases. The bursting and tensile strengths of wet paper usually follow closely resistance to rubbing. The improvement of the wet strength by addition of synthetic and natural plastics is discussed. J. G.

677 : 679.5 *see Abstr.* 760

677.46 : 539.4.01 749

Relative wet strength of cellulose fibres. LAUER, K. *J. Makromol. Chem.*, 1, *pp.* 97–105, 1943.—Differences in the wet strengths of natural and regenerated cellulose fibres may arise from differences in chain length, crystal lattice arrangement and fibre structure. Wet-strength tests on viscose rayon before and after conversion back to the native form (by heating with ethylene glycol and tetra-hydroxyfurfural) indicate that polymorphism is not responsible for wet strength in this case. It is impossible to increase appreciably the relative wet strength of regenerated cellulose by stretching alone, although the absolute wet strength can in some cases be increased in this way. J. G.

678 750

Pigment incorporation in GR-S through latex. MCMAHON, W., AND KEMP, A. R. *Industr. Engng Chem.*, 36, *pp.* 735–738, *Aug.*, 1944.—The physical properties of GR-S stocks prepared by dispersing the pigment in the polymer in the latex stage appear superior to those in which the pigment is incorporated on the mill. Insulating stocks can be made which will have physical properties above those obtainable by present methods. Dispersion of pigments in GR-S latex may prove more economical than mill dispersion. The power consumption would be less.

678 : 539.383 *see Abstr.* 659

678 : 539.389.3 *see Abstr.* 664

678 : 539.4 *see Abstr.* 665

678 : 539.4.016 : 539.389.3 *see Abstr.* 660–662

678 : 539.4.019 : 539.389.3 *see Abstr.* 663

678 : 539.56 *see Abstr.* 669

678 : 541.68 *see Abstr.* 701

678.7 : 676.1.04 751

General aspects of GR-S rubber saturants. NAZZARO, R. T. *Paper Tr. J.*, 119, *TAPPI Sect.*, *pp.* 131–134, *Sept.* 28, 1944.—Advantages of GR-S latex as a saturant for paper are good film-forming properties, colour and fibre-bonding properties, high elongation, freedom from odour, it is readily stabilized, and it is compatible with natural rubber; papers containing it retain their flexibility better than does rubber after accelerated ageing tests, and better than plastics at low temperature; the tearing strengths of such papers are closer to those produced by natural rubber than by plastics. Disadvantages are poor tensile strength (although it is superior to plastics in this respect), slow vulcanizing rate, poor film tear under stress, and limited compatibility with plastics which might otherwise be used to reinforce it. Its properties are compared with those of natural rubber and polyvinyl acetate plastics. J. G.

679.5 752

Synthetic rubber and plastics. Plasticizing of vinyl polymers. HARVEY, J. *Distrib. Elect.*, *pp.* 318–

24, *Oct.*, 1944.—Discusses the factors governing the choice of plasticizers for vinyl polymers, and examines suggestions for explaining the mechanism of plasticizing. M.-V.

679.5 753

High-strength phenolic paper laminates. DICKERMAN, G. K. *Paper Tr. J.*, 118, *TAPPI Sect.*, *pp.* 239–242, *June* 29, 1944.—A sulphite wood pulp sheet, density 0·65, impregnated on a dip-and-squeeze machine with 35 wt% of a phenolic plastic will mould to density about 1·38 at 250 lb./in.^{2} The % of voids at density 1·38 is sufficiently low to give a good balance of physical properties without loss of water- and compression-resistance. Drying at 135–140° for about 5 min. is necessary to remove the solvent prior to lamination. Laminating and moulding processes are described, and the physical properties of cross- and parallel-type laminates are tabulated. Compared with metal, paper laminates are less ductile and more brittle. J. G.

679.5 754

Utilization of lignin in plastics. SCHWARTZ, H. *Pulp Pap. Mag. Can.*, 45, *pp.* 675–678, 1944.—A literature review of the developments in and present position of the use of lignin-containing waste from wood-pulping and -saccharification processes as a plastic or as an extender for plastics. The future prospects of this application are not very promising because products having better plastic properties can be prepared from other materials, and the total tonnage of moulding powders used (in Canada) is very small compared with the available tonnage of waste lignin. Low-priced laminates and board products offer the most likely future. J. G.

679.5 755

Ethers of certain lignin derivatives. JONES, G. M., AND BRAUNS, F. E. *Paper Tr. J.*, 119, *TAPPI Sect.*, *pp.* 104–107, *Sept.* 14, 1944.—The preparation of the ethers of spruce sawdust lignin is described, and possible applications of the new compounds in the manufacture of plastics are discussed. The ether groups enhance stability and hydrophobic properties. J. G.

679.5 756

Phenolic resins for paper-base plastics. KLINE, H. *Paper Tr. J.*, 119, *TAPPI Sect.*, *pp.* 128–130, *Sept.* 28, 1944.—Phenolic plastics for paper laminates may be varied widely according to the type of phenol used, the nature of the catalyst, the properties of the aldehyde and phenol involved, and the reaction conditions. Examples are given, and the mechanism of the reaction is discussed. For extreme resistance to water and chemicals, a combination of 2 plastics is used, e.g., 20% (on the wt of paper) of a penetrating plastic, followed by a standard-type plastic to give a total plastic content of 50%. Very viscous, non-penetrating varnishes produce paper laminates having impact strengths equal to those of canvas plastic laminates. Existing plasticizers reduce the water resistance and the rate of cure of phenolic plastics, or else tend to sweat out of the laminate during curing. Disadvantages of the use of plastics in the beater are low retention and brittleness of the final product. J. G.

679.5 757

Melamine laminates. MALAMPHY, R. H. *Paper Tr. J.*, 119, *TAPPI Sect.*, *pp.* 134–136, *Sept.* 28, 1944.—Special features of melamine paper laminates are high resistance to abrasion, solvents and heat; white and light pastel shades, deeper colours and translucent effects are obtainable. Decorative effects result with pigmented and patterned papers. Careful control of the drying speeds and temperature of the impregnated paper is important to prevent blistering by the solvents, and for the best electrical properties, the solvent content should be below 2%. Treatment of paper with 3% of melamine (from an aq.-alcoholic solution) has no appreciable effect on absorbency, or flexibility, but the wet strength is 60% more than the dry strength, and the dry tensile and folding strengths are improved; these properties are retained on ageing. J. G.

679.5 758

Amino resins. HOFTON, J. *Chem. and Ind.*, 48, *pp.* 410–412, *Dec.* 2, 1944.—Recent developments in connection with the commercially important urea-formaldehyde and melamine formaldehyde resins are reviewed. Consideration is given to moulding powders, adhesives, laminated sheet, low-pressure moulding, resins for varnishes and enamels, and applications to paper and textiles. A. M. T.

679.5 : 539.32 *see Abstr.* 657

679.5 : 539.501 = 3 *see Abstr.* 668

679.5 : 54 759

The chemistry of plastics. CHIRNSIDE, R. C. *G.E.C. Jl.* [*Gen. Elect. Co.*], 13, *pp.* 74–89, *Aug.*, 1944.—Describes in a simple manner the nature and origin of the formaldehyde and aniline resins, cellulose and synthetic polymers (ethylene, styrene and vinyl compounds), acrylic esters and polyamides (nylon). The raw materials (coal, cellulose and oil) are discussed and the possibility of organo-metallic compounds with silica as a base; these would withstand temperatures up to 200°C. E. O. T.

679.5 : 677 760

Plastics and their future in the textile industry. JONES, H. *J. Soc. Dy. Col.*, *Bradford*, 60, *pp.* 225–232, *Sept.*, 1944.

681.4 761

The use of Columbia resin No. 39 as an optical cement. COLES, H. W., DEUBERRY, H., AND CURRY, F. P. *J. Opt. Soc. Amer.*, 34, *pp.* 623–625, *Oct.*, 1944.

77 : 389.6 762

American standards for photography. *J. Opt. Soc. Amer.*, 34, *pp.* 626–632, *Oct.*, 1944.—Gives std. dimensions of X-ray, graphic arts, medical X-ray and professional portrait and commercial sheet film, and for dry plates.

771.3 763

Design method for a Schmidt camera with a finite source. BENFORD, F. *J. Opt. Soc. Amer.*, 34, *pp.* 595–596, *Oct.*, 1944.—Describes a graphical method for finding the form of the curved face of the correcting plate in a Schmidt camera when the source is at a relatively short distance from the camera. The method is capable of giving 5-place accuracy without undue labour. J. W. T. W.

771.53 : 541.147 *see Abstr.* 692

771.54 : 522.61 *see Abstr.* 456

771.54 : 541.147.7 *see Abstr.* 693

771.54 : 545.82 *see Abstr.* 704

771.54 : 548.73 *see Abstr.* 712

772 764

A novel graphical system for representing tone-reproduction data. DORST, P. W. *J. Opt. Soc. Amer.*, 34, *pp.* 597–600, *Oct.*, 1944.—The vertical scale is a linear scale of density, increasing upwards, while the horizontal scale represents degrees of some effect or, as a jump, some operation, e.g. printing or development. The diagram is convenient for showing, at a glance, the effect of a series of operations on tone reproduction and possesses certain advantages over the usual *H* and *D* graph. J. W. T. W.

772.1 765

The quantitative determination of hypo in photographic prints with silver nitrate. CRABTREE, J. I., EATON, G. T., AND MUEHLER, L. E. *J. Franklin Inst.*, 235, *pp.* 351–360, *April*, 1943.—The hypo is converted *in situ* to Ag_2S, the transmission density of the sulphide determined, and the hypo content obtained by reference to a standard curve.

772.534 766

The mechanism of normal fog formation in hydroquinone developers. JAMES, T. H. *J. Franklin Inst.*, 234, *pp.* 371–383, *Oct.*, 1942.—The ways in which fog can be formed are discussed and two are investigated: (1) where there is direct attack by the developing agent upon silver ions in solution or upon unnucleated silver halide surface, and (2) catalytic action of pre-existing nuclei of silver sulphide originating during the ripening process. The characteristics of the reactions are worked out experimentally. A. H.

774/777 : 676.3 *see Abstr.* 747

777 767

A new type of contact halftone screen. YULE, J. A. C., JOHNSTON, F. B., AND MURRAY, A. *J. Franklin Inst.*, 234, *pp.* 567–582, *Dec.*, 1942.—The development of an improved type of contact screen is described. Using a transparent dye for the screen image, contrast control is obtained with colour filters and increased resolution of detail results. The greatest improvement in quality is got by deep-etch offset printing, where it is convenient to make a high-light screen positive from a magenta negative by contact through an orange-red contact screen. A. H.

777 768

Theory of the halftone process. II. The diffraction theory—calculation of the light distribution. YULE, J. A. C. *J. Franklin Inst.*, 235, *pp.* 483–499, *May*, 1943.—It was shown [Abstr. 581 (1941)] that the observed light distribution in the dots formed behind a halftone screen was different from the distribution calculated from the penumbra theory (geometrical optics). A description is now given of an approx. method of calculating (on the basis of Fresnel diffraction theory) this light distribution. For a typical case, the calculated distribution checks closel with that determined experimentally. A. H

777 76

Theory of the halftone process. III. Dot size an halftone density. YULE, J. A. C. *J. Franklin Inst.* 236, *pp.* 473–487, *Nov.*, 1943.—The theoretical an experimental quantitative relationships between th dot dia., dot area, and density of a halftone, are given Experiment does not agree exactly with theory sav for screen negatives and positives with sharp dots For accurate rendering, highlight dots in a reproduc tion must increase extremely rapidly in size for smal density increments in the highlights of an original A "semi-dark-field" densitometer is described which eliminates the effect of dot fringe in measuring den sities of screen positives. The relationship betwee density of screen positive and density of proof i briefly discussed. A. H

778.24 77

Brightness constancy in photographic reproductions EVANS, R. M., AND KLUTE, J. *J. Opt. Soc. Amer.*, 34 *pp.* 533–540, *Sept.*, 1944.—An experimental study o the problem of photographing a simple scene showing the brightness-constancy phenomenon, yields the following results: (1) All objects whose illuminatio is not visibly related to that of the main object mus be lighted to nearly the same illuminance as it (2) the illuminance on shadowed portions of the mai object must be greatly increased; (3) the gradation o illuminance from the main source of light must b decreased by auxiliary lighting; (4) distortion of the tone reproduction scale cannot compensate for los in the brightness-constancy effect; (5) the density o the print must be so adjusted that the main objec appears to have the correct reflectance. A. H

778.3 = 6. 77

Sensitization of photographic plates in ultra-violet AMBROSIS, R. J. *Publ. Fac. Cienc. Fis.-Mat. La Plata* 3, *pp.* 93–101, *July*, 1944.—Various possibilities are studied from the viewpoint of application to the extension of the sensitivity of commercial plates e.g. by reducing the gelatine concentration, by partia destruction of the gelatine with dilute acids, by production of a secondary emission, and the applica tion of an oil solution in benzene. Practical diffi culties impair commercial application. A new method employing a 2% fluorene solution, affords favourable results. Spectra diagrams present a comparison o results. R. M

778.64 77

Direct processes for making photographic prints in colour. MEES, C. E. K. *J. Soc. Mot. Pict. Engrs* 42, *pp.* 230–238, *April*, 1944.—[See Abstr. 1389 (1942)].

778.64 77

Monopack processes. FRIEDMAN, J. S. *J. Soc Mot. Pict. Engrs*, 42, *pp.* 271–278, *May*, 1944.—A method is outlined for making colour separations from colour transparencies. Negative masks are used to correct for the overlaps in the spectral curves of the dye images in the transparency. A. H